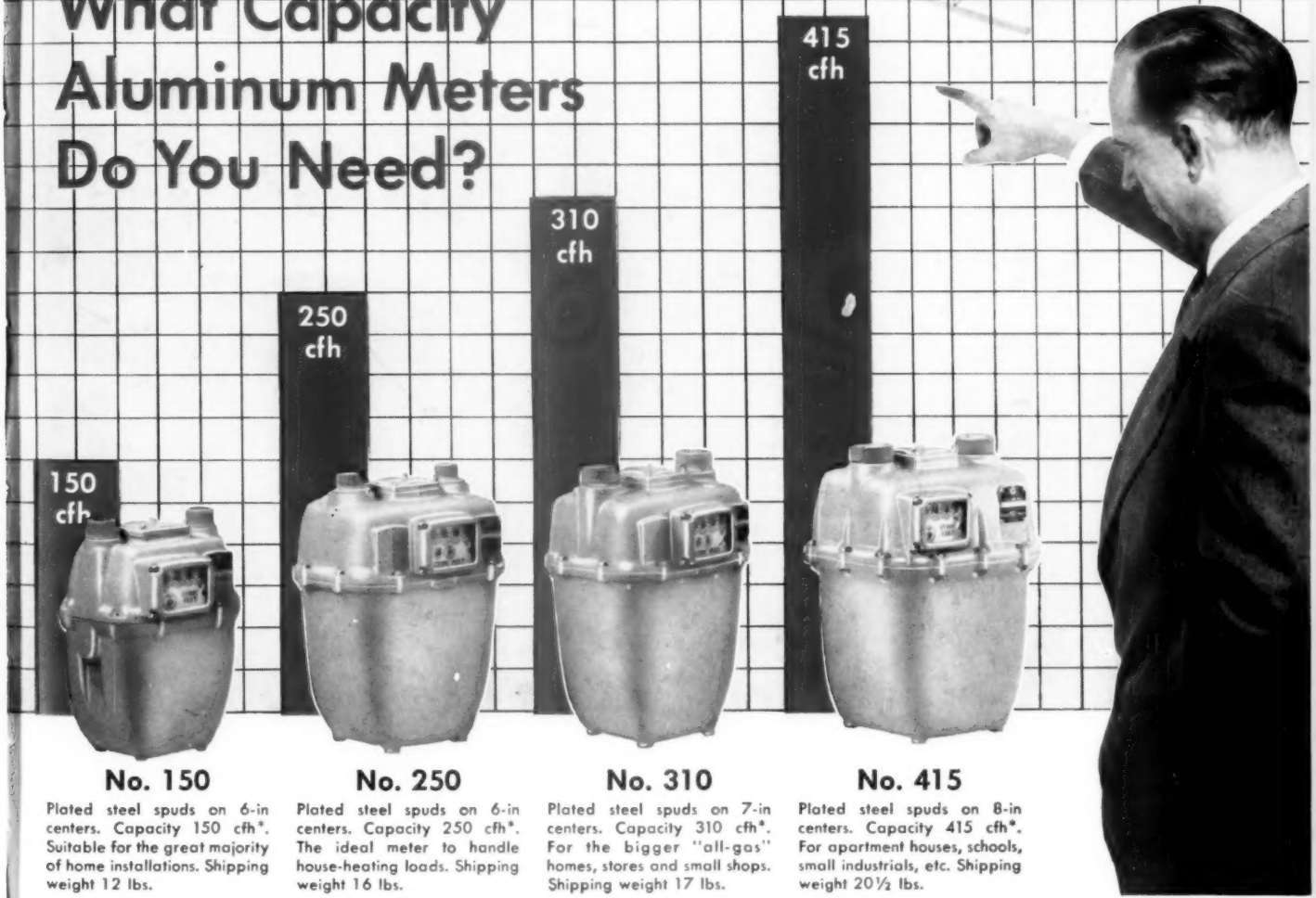
77TH YEAR

JULY 1955
Vol. 182 — No. 7

AMERICAN
Gas Journal

JUL 27 1955

What Capacity Aluminum Meters Do You Need?



No. 150
Plated steel spuds on 6-in centers. Capacity 150 cfh*. Suitable for the great majority of home installations. Shipping weight 12 lbs.

No. 250
Plated steel spuds on 6-in centers. Capacity 250 cfh*. The ideal meter to handle house-heating loads. Shipping weight 16 lbs.

No. 310
Plated steel spuds on 7-in centers. Capacity 310 cfh*. For the bigger "all-gas" homes, stores and small shops. Shipping weight 17 lbs.

No. 415
Plated steel spuds on 8-in centers. Capacity 415 cfh*. For apartment houses, schools, small industrials, etc. Shipping weight 20½ lbs.

*Capacity ratings at ½-in differential of 0.60 sp gr gas.

HOWARD EVANS, Manager, Central Gas Engineering Department, demonstrates the graduated ratings for Rockwell aluminum meters.

The Industry Has Accepted Aluminum Meters!

Only Rockwell Has A Complete Line of Domestic Aluminum Meters with Steel Connections And Single Joint Construction

YOU CAN RELY ROCKWELL ON ROCKWELL

ROCKWELL MANUFACTURING COMPANY
PITTSBURGH 8, PA. Atlanta Boston Charlotte Chicago Dallas Denver Houston Los Angeles Midland, Texas Kansas City, Mo. New Orleans New York Philadelphia Pittsburgh San Francisco Seattle Shreveport Tulsa

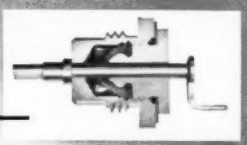
4 new extra values WITH American® Ironcase Meters

Year after year, *American*® meters cost you less to operate — assure you of maximum accuracy with least maintenance.

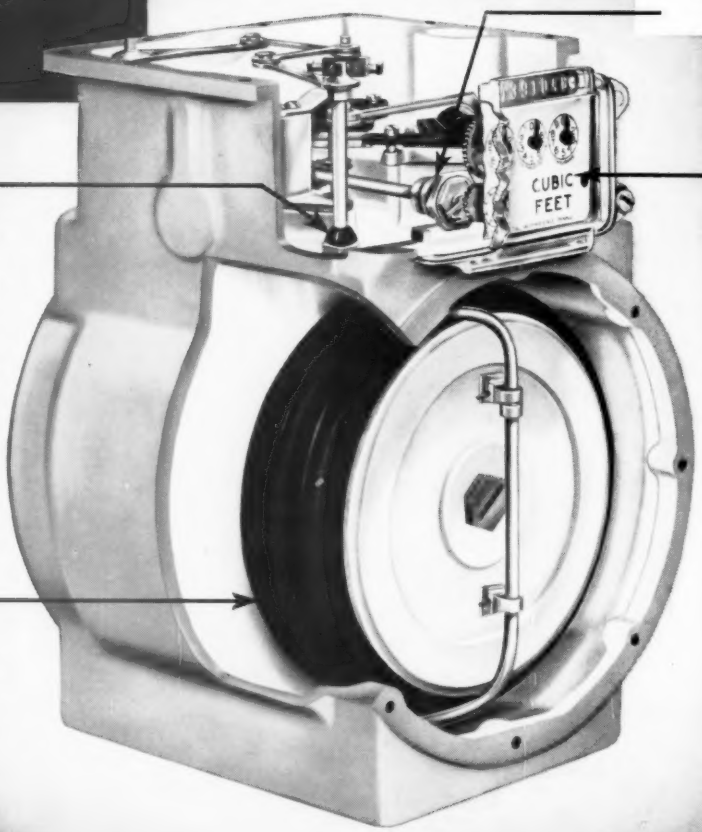
New flag rod and axle box grommet seals, now standard equipment in domestic Ironcase meters, are typical *extra values* developed through constant research for better materials, design and manufacturing methods.

For any application of metering equipment, you are sure of the best when you buy American, the only *complete line* of precision instruments to assure you of "sustained accuracy at lower cost."

NEW composition axle box grommet seals prevent leaks and reduce friction to a minimum . . . no measurable leakage after millions of cycles. Unique design provides greater sealing ability at increased pressures—with no sacrifice in friction.



NEW composition flag rod grommet seals provide uniform, minimum friction and assure dependable, positive leak protection . . . sealing ability unaffected in normal vapor service with natural, manufactured or LP gas.



NEW plastic Index Box is easier to read—equally suitable for exterior or interior meter settings. Molded in one piece, the new box is impact and shock resistant . . . unaffected by ordinary exposure to the elements. Standard on all 3B, 5B and 10B Ironcase and 5B/225 Aluminumcase Meters.

NEW molded Duramic diaphragms developed and produced by American for applications requiring a rugged, composition material . . . provide years of trouble-free service.

New Meter Connection Package— Greater convenience in identifying, handling and storing meter cops and swivels with American's new packaging. These parts are now packed in small unit cartons contained within a master carton, labeled for ready identification — replacing barrels formerly used.

AMERICAN® METER COMPANY

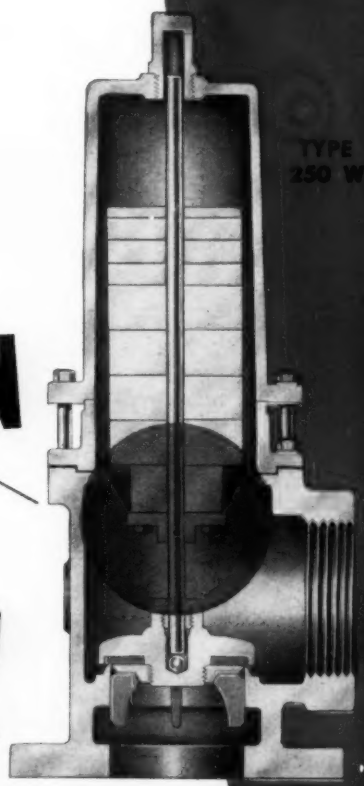
INCORPORATED ESTABLISHED 1887

AMERICAN METER CO.

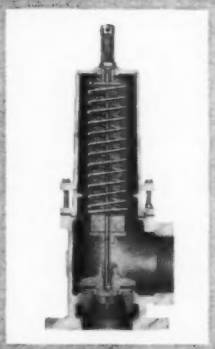
GENERAL SALES OFFICE: 1513 Race Street, Philadelphia
Albany • Alhambra • Atlanta • Baltimore • Birmingham
Boston • Chicago • Dallas • Denver • Erie • Houston
Kansas City • Los Angeles • Minneapolis • New York
Omaha • Pittsburgh • San Francisco • Seattle • Tulsa
IN CANADA: Canadian Meter Company, Limited, Hamilton
Edmonton • Calgary

JUL 25 1955

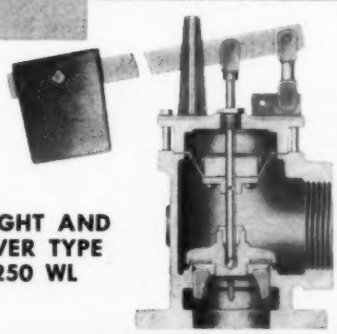
WHAT A DIFFERENCE A "D" MAKES in the NEW CHAPLIN-FULTON High Capacity *Safety Valves*



D stands for diaphragm, and what a difference it makes in the discharge ability of the new Chaplin-Fulton High Capacity Safety Valves—2½ times more flow capacity. After initial opening, the discharge pressure acting upward on the diaphragm insures maximum opening, and guarantees full flow with minimum increase in in the blowing pressure. This means greater protection for the users of Chaplin-Fulton Type 250 Safety Valves, adaptable in three models to all gas systems from ounces to 100 pounds. Sizes 2″ to 6″ inclusive.



SPRING TYPE
250 S



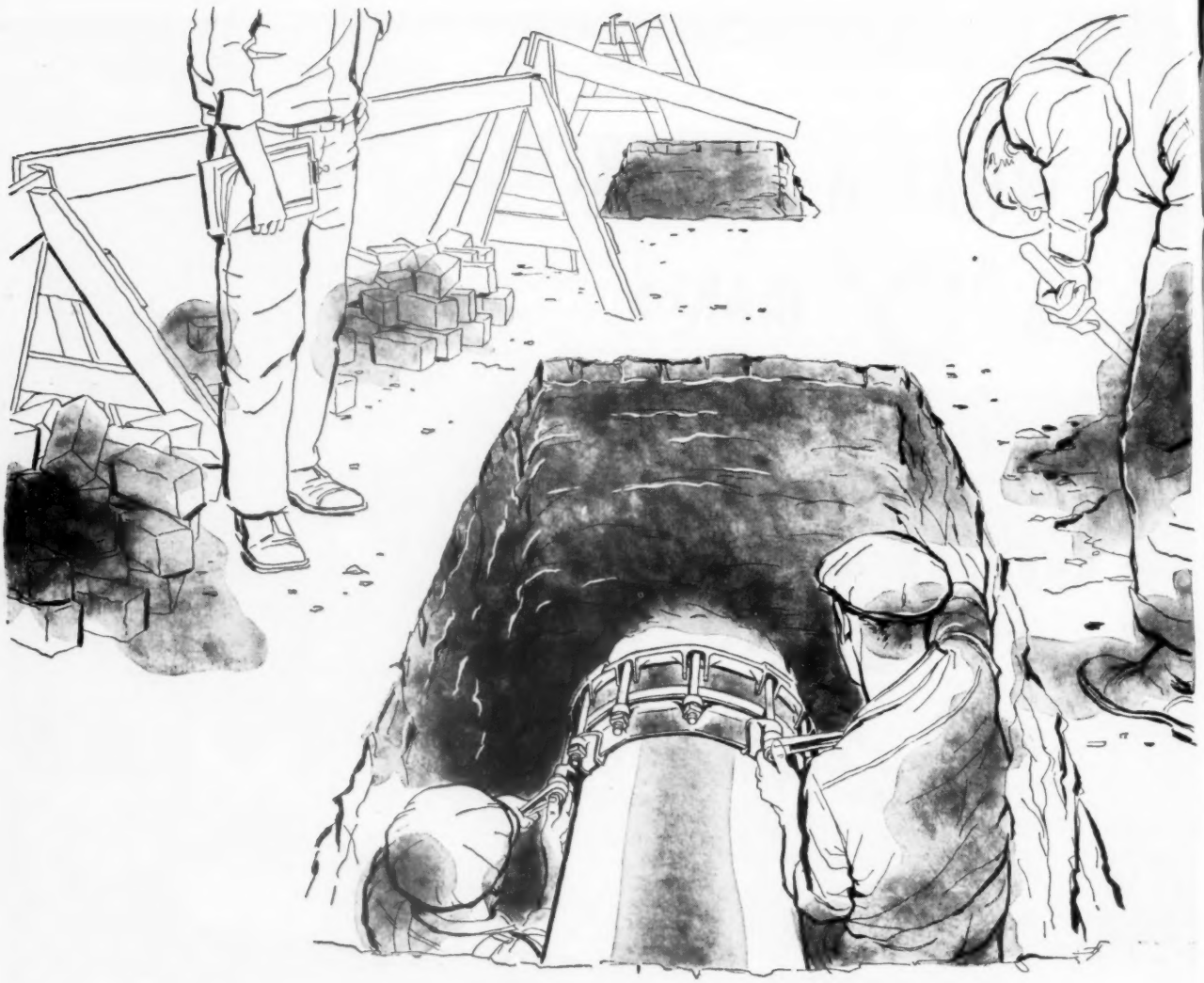
WEIGHT AND
LEVER TYPE
250 WL

Simple.... Foolproof

ACCURATE CP MFG. CO DEPENDABLE

Chaplin-Fulton
MANUFACTURING COMPANY
Pittsburgh 25, Pennsylvania

SV-53-1



PERMANENCE COSTS SO LITTLE

. . . doing it the Dresser way!

Now you can build new line safety into all old cast iron bell-and-spigot joints . . . quickly and at lowest cost . . . using leakproof Dresser Style 60 Bell Joint Clamps.

Whenever you boost pressures, change over to natural gas, or uncover bell-and-spigot joints for *any* reason, install these Dresser Clamps. They are gastight, have resilient rubber gaskets that absorb pipe movement, vibration and other line stresses *without leakage.* Their strong, balanced construction insures uniform gasket pressure at all points and a joint that stays maintenance-free for life.

A full-color, step-by-step training film which shows the correct way to clamp in all situations is available for gas companies. Contact your local Dresser representative or write us to arrange a showing for your service people.

DRESSER.® 75th ANNIVERSARY THE DRESSER WAY 1880 • 1955

FITTING PARTNER FOR THE GAS INDUSTRY

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston; 101 S. Airport Blvd., S. San Francisco. Sales Offices also in: New York, Philadelphia, Chicago, Toronto.

AMERICAN
Gas Journal

VOLUME 182 | 97TH YEAR : : JULY 1955 | NUMBER 7

This month...

THIS IS THE FIRST ISSUE in the 97th year of continuous publication of AMERICAN GAS JOURNAL. During its first 96 years, it has faithfully chronicled the growth of the gas industry from an infant to a giant.

In recognition of the phenomenal progress that has been made, AMERICAN GAS JOURNAL with this issue announces an important change in its editorial program: to become the only publication directed exclusively toward helping the engineering and operating interests of the gas utility industry.

The gas utility industry is big. Its total investment is nearly $10 billion; it serves 28,000,000 customers; its income is nearly $3 billion annually; it supplies more than 25 per cent of the nation's energy; it adds 800,000 new customers annually; it spends $750,000,000 for new facilities annually.

In the past decade, both gas transmission and distribution have grown tremendously. The glamour of the long distance transmission systems has overshadowed the real heart of the gas industry—the utilities, which have also progressed through their own technological advances.

An industry of this magnitude needs a voice. That will be the function of AMERICAN GAS JOURNAL.

This editorial policy change was reached after months of intensive research and planning. Gas utility company personnel—from meter reader to president—as well as manufacturers of utility equipment and appliances were contacted. From California to Massachusetts, Minnesota to Mexico, the response to the idea of a "strictly gas utility publication" has been the same—terrific!

Future AMERICAN GAS JOURNAL issues will reflect continuing close attention to gas utility interests in such fields as . . . operating methods . . . engineering problems and solutions . . . research and development . . . distribution system construction and maintenance . . . management problems . . . instrumentation and communications . . . business office procedures . . . gas utilization . . . appliance merchandising.

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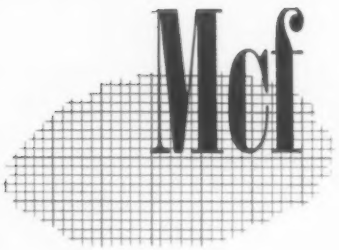


WASHINGTON opinion now indicates grave doubt that legislation limiting Federal Power Commission regulation of producers will reach congressional floors this session. Sen. Douglas (D., Ill.) said to be ready for prolonged discussion; that's deterrent to getting on Senate calendar. The gentlemen want to leave town around Aug. 1.

FPC examiners seem to be of mixed opinion on current regulatory situation of producers. Recently one said no, FPC does not have wellhead jurisdiction; another said yes, in April.

REGULATION of gas at the well: pros and cons—that's subject of bulletin by American Institute of Management. Without taking sides, AIM says "its implications in the entire area of government control are of . . . importance to top management." AIM advises Gas Journal readers may have singles copies; 125 E. 38 St., New York 16.

INVESTIGATION of entire gas industry, proposed in 2 pending resolutions by Rep. Harris (D., Ark.) in H.Res. 267 and by Rep. Wolverton (R., N.J.) in H.Res. 277 probably will not get action during present status of legislation on producers.

INDICATIONS if such investigation gets off ground are in statements made during congressional committees' hearings. Take turmoil within gas industry, add substantially-revitalized coal gang, add coal-state congressmen, add public-ownership group, add miscellaneous groups with "purpose," to get rough—repeating, rough—idea.

EVER HEAR of Senate Bill 2126? That's 1955 housing bill. It has quiet little sneaker under Title 2, that has nothing to do with housing; provides a $100-million revolving fund for publicly-owned utilities, including gas, excluding electric. Passed Senate in June; no House action. More, in August.

EQUIPMENT MANUFACTURERS to gas industry, with no consumer-market products, are under way with industry-support advertising program directly to consumers. Page 41.

PRESSTIME information on Pacific Coast public relations conference in Seattle (GAS JOURNAL, June, p. 17), indicates Northwest conversion will have minimum upset and full information to customers.

GAMA divisions recommend participation in 16 national and regional industrial shows. Question: Is this entering wedge for return of Atlantic City show during AGA convention?

COMMERICIAL COOKING will get push in upcoming annual PEP campaign, preparing at AGA, for action September-through-November. GAMA supports again with $1,000 prize contest.

CHURCH-BUILDING in boom, within otherwise-booming construction, providing attractive load-and-appliances prospects for gas industry. Annual figure for churches upped from $26-million, 1945, to expected $675-million this year.

BUSINESS HEALTH is reflected by John Falvey in rollup of authoritative and significant views he gets at every turn as he moves from his office, deep in NY's Wall St. area. Page 29.

PHILLIPS & BUTTORFF MFG. CO., Nashville, appliance manufacturer, as well as Gas Journal, has been around for 97 years.

OLD DAYS RECALLED . . . *from* AMERICAN GAS JOURNAL . . . once again provides interest, smiles, laughs and perhaps personal flashbacks with monthly selections from files of 90, 50 and 25 years ago. They are reproduced, without editing but with necessary condensation. Temptation is terrific, but comments on some items will not be forthcoming. Page 27.

ADVERTISING to gas industry during 97 years of Gas Journal effort has interest in itself. Later-day advocates of white space, color, short copy and inspired typography will at least groan when we start, next month, series of reproductions of old ads.

ADVERTISERS are getting other attention as we probe pages from 1865, 1905 and 1930. We're selecting and listing firms and since-merged firms that will be readily recognized. Page 44.

PRIDE spilled all over us as we found American Meter Company advertising in 1865, 1905, 1930 — and in 1955.

Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf Mcf

MUELLER®

DEPENDABLE DESIGN

To keep pace with the changing needs of the gas industry, Mueller Co. has designed and built many new features into their complete line of meter stops. Three completely new meter stops, recently developed, which incorporate the safe operating and gas tight features needed to guarantee safe and lasting installations, are shown.

All Mueller Meter Stops have ground and lapped keys, assuring perfect gas tightness. Many other desirable features, such as tamper-proof construction, "O" Ring Seals, completely lubricated key and false ports, give ease of turning and long trouble-free life.

NO-BLO®

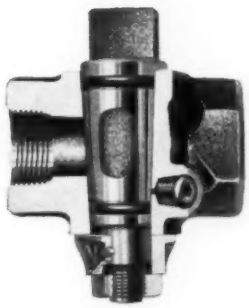
Fully Warranted

See your Mueller Representative, Catalog G-97, or write direct for details and specifications for the complete line.

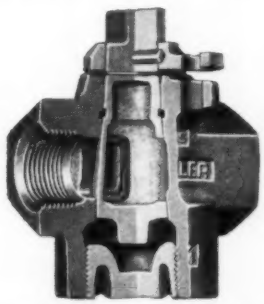
MUELLER CO. DECATUR, ILL.

Dependable since 1857

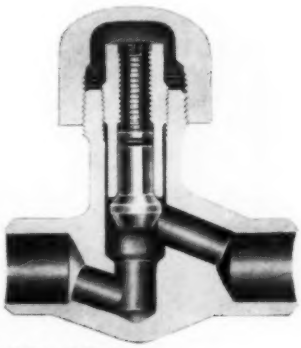
FACTORIES & OFFICES AT DECATUR · CHATTANOOGA · LOS ANGELES · SARNIA, ONTARIO



LubOseal Gas Meter Stop
Absolutely pressure-tight . . . "O" Ring Seals top and bottom . . . completely lubricated key . . . quickly re-lubricated . . . tamper-proof . . . easily and safely installed under pressure with the No-Blo® Stop Changer.



Inverted Key Lubricated Gas Meter Stop
Key seated by stainless steel spring washer and lubricant pressure . . . slight down pressure unseats key for easy turning . . . tamper-proof . . . recessed pentagon head lubricating plug . . . easily and safely installed with the No-Blo Stop Changer.



Capped Steel Valve
Machined from solid steel forging . . . available with ends beveled for welding . . . inside or outside I. P. threads . . . "O" Ring Seal prevents leakage . . . valve mechanism concealed . . . perfectly suited for outside meter settings or other exposed locations.

MUELLER®

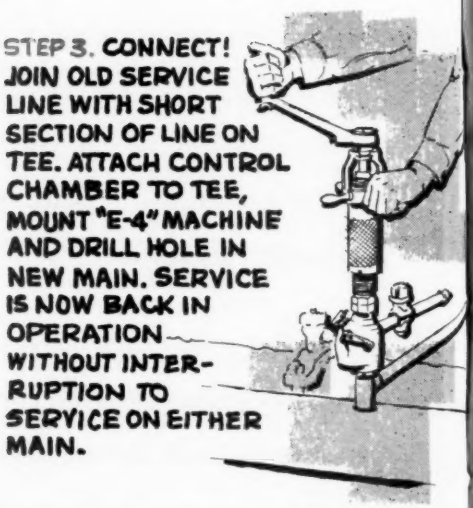
NO-BLO®

Method

STEP 1. WELD! WELD TEE WITH SHORT LENGTH OF SERVICE PIPE TO NEW MAIN, WELD LINE STOPPER FITTING TO OLD SERVICE LINE. ATTACH CONTROL CHAMBER TO LINE STOPPER FITTING.

with the "E-4" Drilling M

TRANSFERS SERVICES SAFELY...



STEP 3. CONNECT! JOIN OLD SERVICE LINE WITH SHORT SECTION OF LINE ON TEE. ATTACH CONTROL CHAMBER TO TEE, MOUNT "E-4" MACHINE AND DRILL HOLE IN NEW MAIN. SERVICE IS NOW BACK IN OPERATION — WITHOUT INTERRUPTION TO SERVICE ON EITHER MAIN.

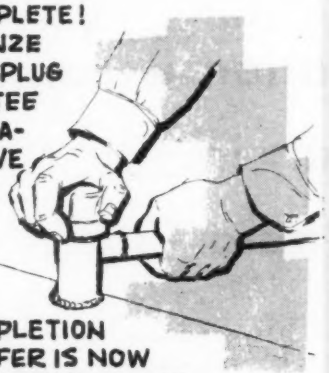
This is another of a series showing the broad application of Mueller No-Blo Fittings and Machines used for their installation.

NO-BLO SERVICE TEE
For connecting service lines to main where valve is not desired . . . provision is made for future shut-off . . . "E-4" is used to drill main, insert completion plug or stop-off under pressure . . . welding or threaded inlet . . . welding, threaded, extended and regular or insulating Dresser outlet . . . pressures to 1200 p.s.i. . . . outlet sizes ¾" through 2½".

NO-BLO VALVE TEE
For connecting service li
to main where valve is
sired . . . completely enclo
valve mechanism requires
machine for operation .
"E-4" is used to drill main
insert valve stem and bu
ing under pressure . . . we
ing or threaded inlet .
welding, threaded, extenc
and regular or insulat
Dresser outlet . . . pressu
to 1200 p.s.i. . . . outlet s
¾" through 2".

STEP 2. STOP OFF! MAKE LINE STOPPER CUT WITH "E-4" MACHINE. REPLACE DRILL WITH RUBBER STOPPER, REMOUNT MACHINE & INSERT & EXPAND STOPPER TO STOP-OFF SERVICE LINE. CUT OLD SERVICE LINE AND CAP END. INSTALL COMPLETION PLUG IN TOP OF STOPPER FITTING, REMOVE EQUIPMENT AND CAP FITTING.

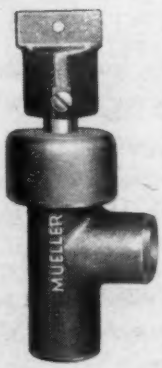
gMachine


STEP 4. COMPLETE! INSERT BRONZE COMPLETION PLUG INTO TOP OF TEE WITH "E-4" MACHINE. REMOVE MACHINE & CONTROL CHAMBER, TIGHTEN PLUG AND ATTACH COMPLETION CAP. TRANSFER IS NOW COMPLETE. SERVICE LINE STOPPER FITTINGS MAY BE SALVAGED FOR FUTURE USE AFTER ABANDONMENT OF OLD MAIN.

"E-4" DRILLING MACHINE
Drills ¼" through 1½"
Working pressures to 500 p.s.i. at 100° F.
Working temperatures to 250° F. at 375 p.s.i.
Boring bar travel—9 $\frac{9}{16}$"
Drills, inserts completion plugs, and stops-off tees and stopper fittings

The increased use of natural gas service has required many communities to replace old gas mains with new, larger mains to meet this demand. By using the Mueller "E-4" Drilling Machine with No-Blo® Service Tees, Valve Tees or Curb Valve Tees and Service Line Stopper Fittings, the transfer of service connections from the old main to the new main is made quickly, under full line pressure—no blowing of gas—no interruption to other services.

For full specifications and more time-and-money-saving applications of the "E-4" Machine and No-Blo Fittings, consult your Mueller Representative, Catalog G-97 or write direct.



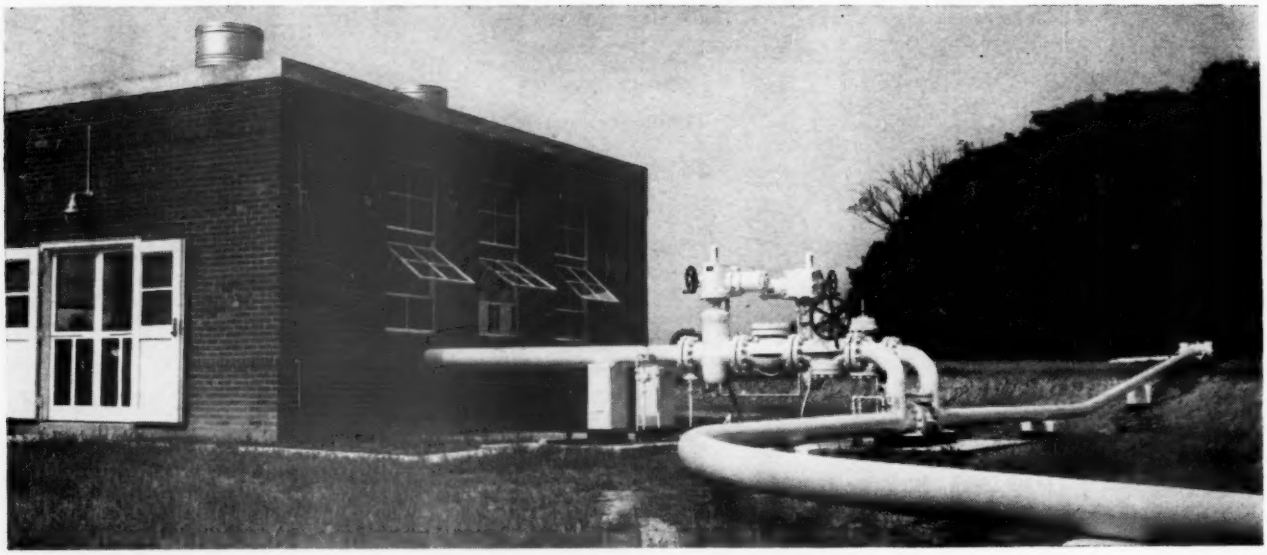
O-BLO CURB VALVE TEE
r connecting service lines
main where an easily ac-
ssible control valve is de-
ed . . . operated from above-
ound through a curb box
. "E-4" is used to drill main
d insert valve stem under
essure . . . welding or
readed inlet . . . welding,
aded, extended and regu-
or insulating Dresser out-
. . . pressures to 1200 p.s.i.
. outlet sizes ¾" through
".

NO-BLO SERVICE LINE STOPPER FITTING
For stopping-off service lines at any point to repair or replace lines without a shut-down . . . "E-4" is used to drill line, make stop-off and insert plug under pressure . . . welding type only . . . sizes ¾" through 1¼".

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS



This Illinois pumping station is controlled by a man in Radio City

When dialed, the pumping station automatically sends its meter readings via teletypewriter to the dispatcher in New York.

Shell Oil Company's automatic pipeline pumping station in Dennison, Ill., is supervised and controlled over Bell System lines from an ordinary telephone dial in New York City—more than 800 miles distant!

For meter readings, Shell's dispatcher in New York's Radio City dials a number. Back on the teletypewriter from the Dennison station come suction and discharge pressures and motor current readings.

He dials other numbers to start or stop the pump, open or close valves or to summon an attendant.

This remote-control system keeps the pipeline—which carries 22 different finished petroleum products—operating smoothly from one central location. Dennison is only one of four similarly controlled pumping stations on the line.

Using Bell System communications, you get the benefit of new developments without tieing up capital.

We supply the pipeline industry with reliable private line telephone and teletypewriter service, maintain mobile radio facilities and provide channels for telemetering and supervisory control.

Bell System communications engineers will be glad to survey your communications needs without charge. Call your Bell Telephone representative today.

BELL TELEPHONE SYSTEM

TELEPHONE TELETYPEWRITER MOBILE RADIO TELEMETERING AND REMOTE CONTROL CHANNELS

A MATTER OF CONVICTION

CONVICTION has dominated consideration of expressions on this page during the past 6 years. Under no circumstances but *high* conviction would we devote space here to matters that pertain to a single manufacturer of gas appliances. Indeed, the space is limited to one of that manufacturer's appliances—the gas refrigerator.

The gas utility industry needs its refrigerator. Prestige value, load protection and load value are characteristics of the gas refrigerator that make it vitally important to utility sales plans and activities. Happily, that view has already been expressed in substantial form by a significant body of utility executives.

The new viewpoint of Servel's management is extremely heartening; it has the effect of relaunching the gas refrigerator. That viewpoint merits all support it has received. But, it is cross-industry support that will develop maximum local impact. Can that support be obtained? We believe it can.

Certainly, Servel top-management, during a series of personal conferences with utility executives, was nothing but utterly frank. At the same time, they announced policies which reflect good faith and unselfishness—all in line with good business and reflecting sincere desires to overcome some past history.

Yes, some gas utility executives have put the refrigerator back into sales and merchandising action. Others have indicated they plan to do so.

May we address ourselves respectfully and directly to those who have either cast a negative vote or no vote at all? To them: Consider the gas refrigerator fully —for itself, of course, and for its implications on other domestic loads. Think it out to find the points of prestige value, load protection and load value.

All gas utilities do need the gas refrigerator; and the refrigerator needs the utilities—all of them.

The competitive position of the electric refrigerator is stabbed with neatly mortal effectiveness when the details of gas refrigerator installation become part of gas utility routine. Operational advantages of the gas unit are too well known to require labor here.

With the gas refrigerator back in the act, the all-gas kitchen is saved; without it, that kitchen is a myth.

Worthwhile repetition: the refrigerator contributes mightily to holding cooking load, water heating load, incinerator load, drying load, heating load and air conditioning load. But, *more important*, it is a big factor in building *new* loads.

As the final expression of conviction, we propose August 1 as Think-About-the-Gas-Refrigerator Day for all gas utilities. That thought-time will accrue most favorably over the months and years, we believe.

How High-Temperature Jets are Utilized in Some Industries

Henwood of Selas discusses precision, speed, reproducibilty before ASME

JAMES B. HENWOOD, during the presentation of his paper dealing with industrial utilization of high-temperature gas jets, before the international combustion conference sponsored by The American Society of Mechanical Engineers and The Institution of Mechanical Engineers, made a notable contribution to broader understanding of both presently applied techniques and the potentials for the future as those techniques are extended. His discussion is commended to the industrial engineers in all gas utilities for its value in emphasizing the broad applicability of gas to industrial processing: large and small equipment; solid or fluid materials.

James B. Henwood

Henwood is a development engineer, Selas Corporation of America, where he has been active in heat processing research for 13 years. A former gas utility engineer, he was with Philadelphia Gas Works Division, UGI, after graduation from Drexel Institute of Technology, until he joined Selas.

● THROUGHOUT OUR INDUSTRIAL ECONOMY, there are few—if any—exceptions to the requirement that heat is essential in the processing of manufactured products. At some point in the progress from raw material-to-finished product, heat is applied to bring about physical or chemical changes that influence quality, quantity and economics of production.

The utilization of gas in industrial processing has expanded to tremendously-important proportions in utility load-and-revenue considerations. At the same time, applications and results have become dramatic, from the viewpoint of overall-industry.

Jet-type applications of gas were the subject of James B. Henwood, development engineer, Selas Corporation of America, during his presentation at a joint conference on combustion, sponsored by The American Society of Mechanical Engineers and The Institution of Mechanical Engineers of Great Britain, in Boston during mid-June.

Henwood's paper is presented here with substantially the same detail as in its Boston appearance. While some of his original illustrations have been omitted, the essential graphics that relate to his principal subject are reproduced.

The time rate of addition or removal of heat in materials not only often determines whether a product can be produced economically, or whether its quality is superior to others; but, in some cases, even determines whether or not it can be manufactured.

Thermal jets have long been associated with the transfer of heat to process materials. High-velocity, high-temperature jets are readily produced by combustion of industrially available fuel gases with air and/or oxygen. Relatively little information has appeared on the application of high-velocity jets to industrial processing.

AMERICAN Gas Journal FEATURE

In industrial heating processes the objectives are thrust, heat transfer, chemical reactions and controlled utilization of these effects to produce new or improved products more economically and efficiently.

Jets for industrial applications

Jets resulting from gaseous combustion possess numerous properties of economic importance to process industries. Before they can be adequately utilized, their creation, disposition and implications in relation to specific processes must be evaluated.

Conversion of chemical potential energy into heat and mechanical energy occur during combustion, accompanied by great rise in temperature and appearance of sensible heat in the products of combustion. It is with these gases that time-temperature cycles must be satisfied. Their proper disposition with respect to an existing or contemplated process is a problem of major importance that deserves greatest attention toward the successful solution of processing problems.

To utilize fully combustion of oxidant and fuel gas mixtures, the following objectives should be recognized:

1. Combustion reaction should take place in minimum possible time to confine it to minimum space required, to utilize highest possible energy level.
2. High-temperature gases must transfer heat, directly or semi-directly to object, in a controlled manner, as dictated by process requirement in order that time-temperature requirements can be met.
3. Velocity and temperature of jet must be developed to solve process problems involving simultaneous heating, mechanical forming and conveying of materials.

Combustion necessarily implies a burner which is more technically a transducer. (A transducer, by definition, is a device that receives energy in one form and delivers it in another, suggesting that planned conversion and distribution of energy is incorporated in its design and application.)

Internal combustion nozzle

An internal-combustion nozzle designed for high-velocity jet applications is composed fundamentally of the parts illustrated in Figure 1.

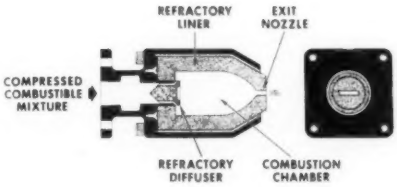


FIG. 1. Internal combustion nozzle.

Compressed stoichiometric combustible mixture, either premixed or nozzle mixed, is admitted through diffuser into the combustion chamber, where combustion is completed—at high to very high rates per unit of combustion volume—dependent upon design and required performance. The refractory liner reduces heat loss and, when incandescent, contributes to attainment of high combustion rates.

Completely burned combustion products issue from the exit nozzle at approximately 3,000F mixtures of air and fuel gas. Velocities depend upon physical properties of combustion products and nozzle pressure ratio.

A nomogram for calculating theoretical jet velocities of gases expressed as a function of nozzle pressure ratio, ratio of specific heat, and temperature of gas entering nozzle is presented in Figure 2. The data indicate typical practical values of gas temperature at nozzle inlet, corresponding average specific heat and ratio of specific heats for the temperature ranges suggested; when burning mixtures of methane and air, methane and air enriched with oxygen, and methane and pure oxygen. The gas temperature range at nozzle inlet is typical of existing designs where internal area of the refractory combustion chamber approaches a minimum per unit volume, and heat release is greater than 10-million Btu/cf of combustion volume/hr.

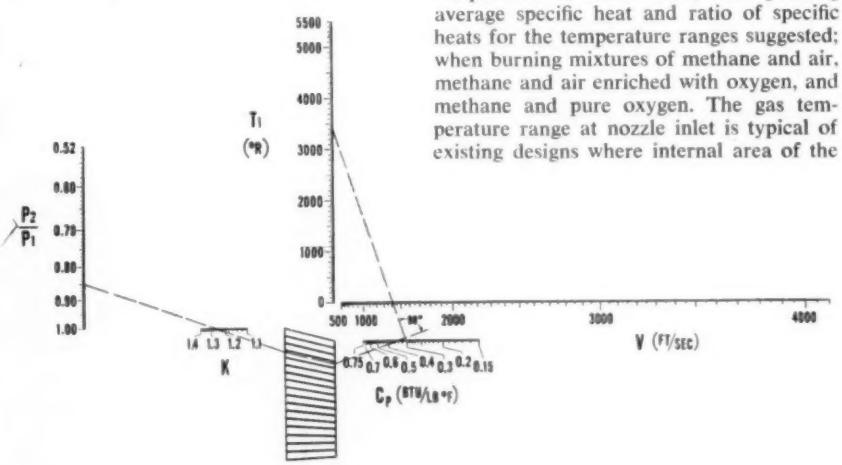


FIG. 2. Monogram for calculating theoretical jet velocities.

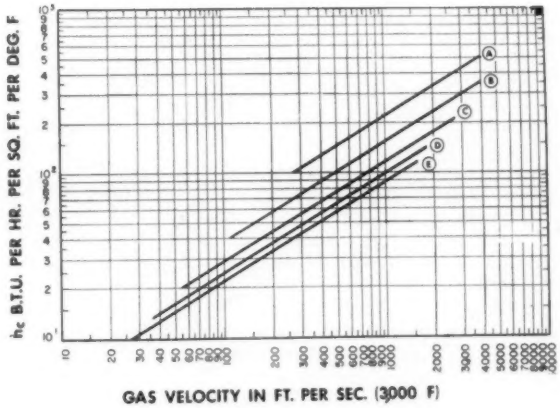


FIG. 3. Coefficent of heat transfer by convection with an air stream flowing at right angles across the outside of a cylinder.

$$Re = \frac{D_o V}{vf} = 1{,}000\text{-}50{,}000$$

D_o = Cylinder, *od*, in
A = 0.10″
B = 0.25″
C = 0.50″
D = 0.75″
E = 1.00″

Air-fuel gas mixture (stoichiometric)	Gas temperature at nozzle inlet, *R*	Average c_p Btu/lb °F	Average *K*
Methane and air (21% O_2 + 79% N_2)	2,900-3,400	0.350	1.260
Methane and oxygen-enriched air (42% O_2 + 58% N_2)	3,900-4,400	0.405	1.220
Methane and pure oxygen (100% O_2)	4,900-5,400	0.517	1.166

$$V = [2gJc_P T_1\{1 - (P_2/P_1)^{(K-1)/K}\}]^{1/2}$$

- V Velocity of gas nozzle exit, fps.
- T_1 Temperature of gas entering nozzle, R.
- P_1 Upstream chamber pressure, psia.
- P_2 Exit pressure, psia.
- c_p Specific heat of gases at constant pressure, tu/lb/°F.
- g Conversion factor in Newton's law of motion = 32.2 ft × lb mass/sec² × lb force.
- J Mechanical equivalent of heat = 778 ft lb/Btu.
- K Ratio of specific heats = c_p/c_v.

The nomogram example illustrates a solution of the equation for a desired nozzle-exit velocity of 1,400 fps; given an inlet-nozzle gas temperature of 3,400 R, an average specific heat at constant pressure of 0.35 Btu/lb/°F, and an average ratio of specific heats, *K*, of 1.26, for which required nozzle pressure ratio is 0.85. When the nozzle is discharging to atmosphere, a combustion chamber pressure of 2.6 is required to produce the desired velocity. What does this mean in terms of convection heat transfer?

Figure 3 illustrates the effect of gas velocity on the convection heat transfer coefficient h_c expressed in Btu/hr/sq ft/°F for various diameter cylinders for the special case of full flow at right angles across the outside of a cylinder. The gas (air) temperature is 3,000F, indicative of temperature at the internal-combustion nozzle exit, previously described when burning fuel-gas with air. The physical properties of air are sufficiently close to theoretical combustion products to permit their use for purposes of illustration.

The temperature of the gases at 1,400 fps is slightly less (approximately 75F) than at nozzle inlet, owing to increase in kinetic energy of the jet. This effect is neglected here.

In Figure 3, the convection heat transfer coefficient h_c for a cylinder of diameter 0.25″ is equal to aprpoximately 188 Btu/hr/sq ft/°F, at a gas velocity of 1,400 fps and a gas temperature of 3,000F.
Air temperature = 3,000F

Illustrating the relative magnitude of heating rates possible using high-velocity jets, by applying the information given in Figures 1, 2 and 3, it is possible to estimate the time to heat an object through a given desired increase in temperature by applying this integrated equation:

$$\Theta_c = 3{,}600 \times \frac{W}{A} \times \frac{c_p}{hc} \times \log_e \frac{t_j - t_1}{t_j - t_2}$$

where

Θ_c heating time from temperature t_1 to t_2 by convection in seconds;

W weight of object heated, pounds;
A cylindrical area of object heated, sq ft;
c_p specific heat of object, Btu/lb °F (average between t_1 and t_2);
h_c convection coefficient of heat transfer, Btu/hr/sq ft/°F;
t_j temperature of the jet, F;
t_1 initial temperature of object, F;
t_2 final temperature of object, F.

The following conditions are proposed:

1. Temperature of jet constant at 3,000F,
2. Initial temperature of the object, t_1, 100F,
3. Final temperature of object t_2, 1,500F,
4. Dimensions of object, ¼" by ½" long,
5. Material of object, low carbon steel, 490 lb (1 cu ft),
6. Average specific heat of object between temperatures t_1 and t_2 0.15 Btu/lb/°F,
7. Convection coefficient, 188 Btu/hr/sq ft/°F,
8. Convection coefficient, constant during heating of object.
9. Heat conduction in object, neglected.
10. Radiation from object during heating, neglected.
11. Phase change in object during heating, none.

Under these conditions the heating time becomes

$\Theta_c = 5$ sec (3,000F jet, velocity 1,400 fps).

If velocity be reduced to 150 fps, heating time becomes

$\Theta c = 19$ sec (3,000F jet, velocity 150 fps).

New effects

In addition to the relatively high convection heat transfer coefficients available with jet-type burners, the high-velocity jet produces shear and drag upon objects so heated. This combination effect permits new processes and products, which include

1. Continuous forming of micro-fine filaments from viscous materials;
2. Atomization of molten liquids;
3. Combined continuous melting and atomization of liquids at jet;
4. Localized heating of metals preparatory to effecting metallurgical transformations in prescribed patterns;
5. Simultaneous fluidizing, heat treatment, and conveying of granular materials;
6. Submerged direct heating of liquids;
7. Continuous singeing of textiles at high speeds;
8. Fire polishing of glass.

Of equal importance to heat transfer, shear, and drag, but of distinct significance, are present studies of ultra-high-speed chemical reactions taking place in the flame fronts of high-temperature gaseous jets.

Radiant burner

A second type of burner utilizes high-velocity high-temperature gaseous jets in a different manner to achieve an entirely different heat-transfer effect on process materials.

A radiant burner is illustrated in Figure 4. Its functions: Stoichiometric combustible mixture, premixed or nozzle-mixed, is discharged in the form of numerous jets, into contact with the surface of a relatively flat refractory concavity. Fluid flow and rapid heat transfer between gases and refractory is the basis for design of concavity. Within normal capacity range, the gases escape from the concavity as final products of combustion.

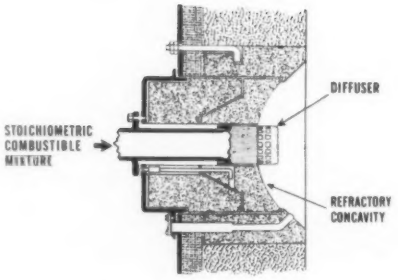


FIG. 4. Radiant burner.

Certain inherent features of the radiant burner permit processing methods and resulting products to be reevaluated on bases other than cost of fuel or reduction of heating time alone.

These features include:

1. Rapid conversion of chemical energy in the fuel into sensible heat in the gases within the geometric confines of cup. This is accomplished by utilizing effect of turbulence and reaction-supporting properties of incandescent refractory;
2. Partial conversion of sensible heat in gases to high-level radiant energy in the refractory concavity. This effect is obtained by designing to permit control of convection heat-transfer coefficients (gases-to-refractory) to surface of the refractory concavity;
3. Discharge of high-temperature combustion products into the work space—but not at work itself—thereby minimizing localized impingement upon process material.

The practical significance of the radiant burner to the process engineer may be understood as follows:

1. Heating chamber dimensions are function of product dimension and radiation configuration factor between emitter and receiver—whichever is of controlling importance in contemplated design;
2. Radiant burner permits new methods of handling process products, involving small, rugged heating structures (semi-furnaces) of low heat-storage capacity and nearly instantaneous radiant temperature-response to production demands;
3. Process materials can be exposed to time-temperature cycles on individual, continuous basis, thereby greatly minimizing possibility of non-uniform treatment as contrasted with bulk, long-cycle heating;

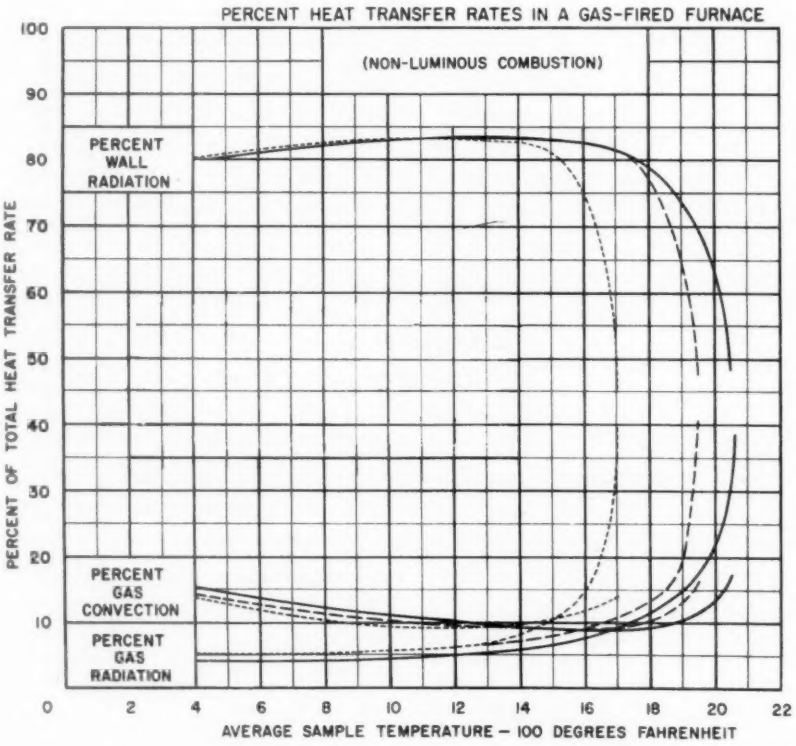


FIG. 5. Curves for heat transfer rates in a gas-fired furnace.

80% of heat transferred by radiation from furnace walls.

- - - - - - - - - Average furnace gas temperature 1,960 F.
Average furnace gas temperature 1,750 F.
— — — — Average furnace gas temperature 2,250 F.
Average furnace wall temperature 2,010F.
———— Average furnace gas temperature 2,400F.
Average furnace wall temperature 2,100F.

4. Exposure time of product to temperature is drastically reduced (from hours to minutes or seconds) often creating improved physical properties in product;
5. Application of number of burners to heating unit, thereby utilizing thermal energy more effectively while at high energy levels. High rates of heat transfer to object are achieved with geometric control of heat transfer pattern;
6. Radiant burners are placed close to object without danger of localized heating, owing to absence of torching, by high-temperature gases, upon critical material.

Refractory enclosures operating at average wall temperatures above 1,750F transfer, by wall radiation, 80% heat absorbed by object.

Figure 5 illustrates distribution of the various modes of heat transfer. An increase in percentage of total heat transfer by convection is evident as average sample temperature approaches furnace wall temperature and radiation term approaches zero.

The high percentage of heat transferred by radiation is maintained for a higher sample temperature if the wall temperature is increased.

The radiant burner is one method of approaching this condition by introduction of many radiant sources, burners, into the refractory wall, thereby converting part of the highest-temperature sensible heat in gases to radiant energy at high temperature. The transfer of heat by radiation to workpiece areas is a simpler process to evaluate and control than that by high-temperature *random* convection.

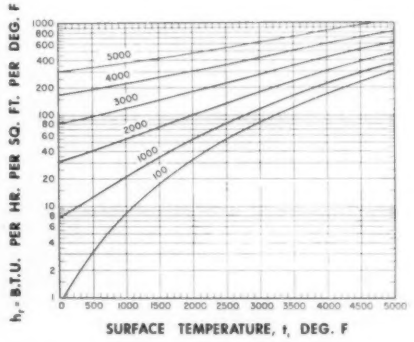


FIG. 6. Coefficient of heat transfer by radiation.

Number on curves refer to temperature of surface 2.

$$h_r = \frac{q_r}{A_1(t_1 - t_2)} = \frac{0.171\varepsilon_1\left[\left(\frac{T_1}{100}\right)^4 - \left(\frac{T_2}{100}\right)^4\right]}{T_1 - T_2}$$

h_r Btu/hr/sq ft/°F
q_r Btu/hr
A_1 Area, sq ft, surface 1
ε_1 Emissivity of surface 1 = 1.0
T Absolute temperature, deg R

Figure 6 illustrates coefficient of heat transfer by radiation when the 2 surface temperatures are known. Coefficients have been extended to include surface temperatures to 5,000F and are convenient for estimating heat transferred by radiation for temperature differences occurring when oxygen enrichment or preheated air are used.

Heating Time for Metals by Radiation—Heat Transfer

Material	Size, in.	Temperature of enclosure, F	Initial temperature of object, F	Final temperature of object, F	Heating time
Steel, carbon, rd	dia 2	2,300	60	2,000	6.6 min
Steel, carbon, rd	dia 2	2,700	60	2,000	3.0 min
Steel, strip, bright	0.010	2,000	60	1,300	5.2 sec
Steel, strip, bright	0.010	2,500	60	1,300	2.3 sec
Brass, strip, 85-15	0.010	2,500	60	1,300	1.7 sec

In the accompanying table theoretically computed values are given. They represent heating rates obtained in actual practice. In these calculations certain assumptions have been made:

1. Transformation phase change in metals is neglected;
2. Heat transfer by conduction in metal is neglected;
3. Area of enclosure is large compared to area of enclosed object.

It is evident from the accompanying table that small increases in enclosure temperature significantly reduce heating time.

The effectiveness of radiant heating can be efficiently utilized only when conversion, by convection, of sensible heat in combustion gases to radiant heat in solid surfaces takes place under controlled conditions.

Part 2 of Henwood's discussion of high-temperature, high-velocity gas jets for industrial heat processing will appear in the August issue.

Columbia Dean Shows Position of Gas in Energy Industry

Potentialities for applying atomic energy to our normal peacetime industrial scene are enormously important to the gas industry, in the opinion of John R. Dunning, dean, faculty of engineering, Columbia University, expressed to a gas industry group, recently.

"Our whole industrial civilization in this country is primarily an energy-based technology, of which natural gas is a major factor," Dean Dunning said. "Through the use of energy, we have built a whole new type of civilization in this country. We have today 125 to 150 installed horsepower per person. Through the use of coal, gas and oil, industry supplements every production line worker with energy equivalent to about 250 workers.

"We turn to atomic energy as a feasible solution for future resources," he continued. "We have a bench-mark which indicates that our atomic energy reserves are at least 25 times as great as the reserves of coal, oil or natural gas.

"Actually, this must be viewed as a preliminary figure, which will be very much increased by new exploration and new developments. It would not surprise me to find that our atomic energy reserves are 100 times those of fossil fuels.

"Uranium occurs in many forms, some of which will be cross-linked with the future of natural gas distribution. Minerals containing uranium go through a number of steps. A pile of uranium the size of an auditorium stage will make uranium metal that one man can carry. In most applications today, this metal is further refined by gaseous diffusion plants.

"This method produces basic uranium 235, the separated isatope, at a surprisingly low cost," Dean Dunning continued. "1" cube of solid uranium, somewhat enriched in U 235 weighs about 1-lb. It is equivalent to 3-million-lbs. of coal or 30 MMcf of gas. Ten such 1" cubes would supply the entire Cincinnati area for one day.

"Engineers in our energy industries are thinking about how to use this enormous potential energy fuel," the Columbia dean emphasized. "The first large scale atomic power plant is being built by the Duquesne-Westinghouse group in the Pittsburgh area. The atomic energy business has been turned over partly, at least, to private industry. A number of major utility groups have started firm programs to construct large-scale power plants using atomic energy. Consolidated Edison in New York has a far-sighted program.

"Some of the newer electric power plants are only burning three-quarters of a pound of coal per kwhr of electricity. Almost from the first, industrial atomic power can be produced in the same range as conventional fuel costs. We look forward to greatly reducing apparent fuel costs through the mechanism of breeding, using uranium as the basic fuel of a reactor and surrounding it with thorium. Before long, the apparent fuel costs should be well below that of coal in many parts of this country.

"Now where does this leave natural gas?" Dean Dunning asked. "I am amazed to see the rapid entry of many of the oil companies into the uranium field. Many coal companies are entering the picture. This means our energy industries are beginning to diversify. And just as uranium has great advantages in many applications, so gas has great advantages in others.

"I cannot believe that the distribution systems will not be useful and valuable for a long time because of the special nature of gas as an energy source.

"The gas industry apparently will be able to sell all the gaseous fuels it can produce and distribute more or less indefinitely.

"The main point," he stressed, "is to retain its competitive position and supply the current demand."

LP-Gas Storage for Utilities

Phillips group discusses all methods

● STANDBY AND PEAK-LOAD GAS are increasingly important utility operating considerations as new service areas are opened with their residential heating loads to be added to the growing loads in established areas.

Storage is the generally-held solution but that, in itself, presents new problems for some companies.

Recent developments in LP-gas storage, with utilities in mind, were discussed by W. H. Kramer, E. W. Evans and C. MacSporran, all of Phillips Petroleum Co., in their joint presentation before American Gas Association's chemical, engineering and manufactured gas production conference recently.

Storage of LP-gas in underground caverns "appears to offer to the gas utilities the lowest cost . . . in those areas in which underground formations are favorable," Kramer, Evans and MacSporran said.

Their discussion recognized all generally-used storage methods, with available cost ranges, and is presented here in somewhat condensed form.

According to a recent report by American Gas Association, some 14-million homes in the United States were heated with gas during January 1955 as compared to 12.9-milion in January 1954, an increase of 9%. The colder weather experienced throughout most of the country the past winter, as compared to the previous year, also added to the peak demand for gas during the heating season.

The seasonal variation in demand for natural gas is illustrated by this table, based upon data from U. S. Bureau of Mines quarterly natural gas reports. Total includes residential, commercial and industrial sales, but not quantities used for carbon black or field operations.

Period	(billions of cubic feet) Total	Residential
4th quarter, 1953	1,616.0	434.0
1st quarter, 1954	2,035.6	833.9
2nd quarter, 1954	1,523.7	415.2
3rd quarter, 1954	1,277.3	176.5

The ratio of total sales for the maximum quarter to that for the minimum quarter during this period was 1.59. For residential sales, the ratio was 4.72, indicating the profound influence of house heating load on peak demand.

There seems to be every indication that gas demands for house heating will continue to increase rapidly.

Increases are predicted on the assumption that additional gas volumes will be available to supply the new customer load. For practical purposes, however, the effect of gas producer regulation on new supplies must be considered.

Unless the gas utilities can develop compensating summer loads, such as a very large increase in gas fired air conditioning, it is certain that the winter-to-summer ratio of gas sales will continue to increase. Since it is not economically feasible to install pipelines solely for seasonal or part-time operation, standby facilities must be provided if the industry is to continue its present rate of expansion.

W. H. Kramer

E. W. Evans

C. MacSporran

Prestressed concrete cylinder storage.

In an effort to meet peak-load requirements, the gas industry has employed main methods:

1. Underground storage of natural gas in depleted gas or oil fields;
2. Standby gas production equipment, usually of the high; Btu oil gas type
3. LP-gas standby units.

Underground storage of natural gas

The underground storage of natural gas in or close to major consuming areas has shown a remarkable growth since 1949. The AGA committee on underground storage in its first annual report, estimated that as of January 1, 1952, the combined ultimate capacity of underground natural gas reservoirs was 916-billion cf and total capital expenditure for this purpose was $170-million.

Suitable natural underground reservoirs are not always available where needed but, in general, are located in areas which have produced natural gas or oil. Storage of natural gas in water sands, caves and abandoned coal mines might be practical in isolated cases, but introduce many problems of confinement, contamination and safety. In several states, the mining industries have opposed underground storage in areas in which they operate. Lack of power of eminent domain for acquisition of surface and mineral rights, for development of underground storage reservoirs has been, in some instances, a determining factor. Recently, however, the mining industry appears to be taking a more conciliatory attitude, and there is a reasonable chance that gas storage operators may be granted right of eminent domain under certain conditions.

Standby artificial gas equipment

In manufacturing high-Btu gas, many utilities employ oil generators to supple-

ment their natural gas supply during periods of peak loads. These units require an experienced force, are slow in getting on stream, and, unless capital investment is relatively high, are limited in capacity. Properties of such gas are usually quite different from those of natural gas and appliance operations difficulty may result. Unless equipment used in former operations can be utilized, with or without modification, a high investment in equipment, oil storage and handling equipment, and purifying units, as well as high operating costs, results.

LP-gas for peak load

LP-gas can be used either to augment the supply distributed through the mains, usually by addition of an LP-gas-air mixture of suitable calorific value and specific gravity, or to provide an alternate supply for large industrial or commercial accounts served under an interruptible natural gas agreement. It has obvious operating advantages over high-Btu oil gas and other peak load or standby fuels, such as considerably less time required to place in operation and shut down, along with minimum requirement for trained operating personnel.

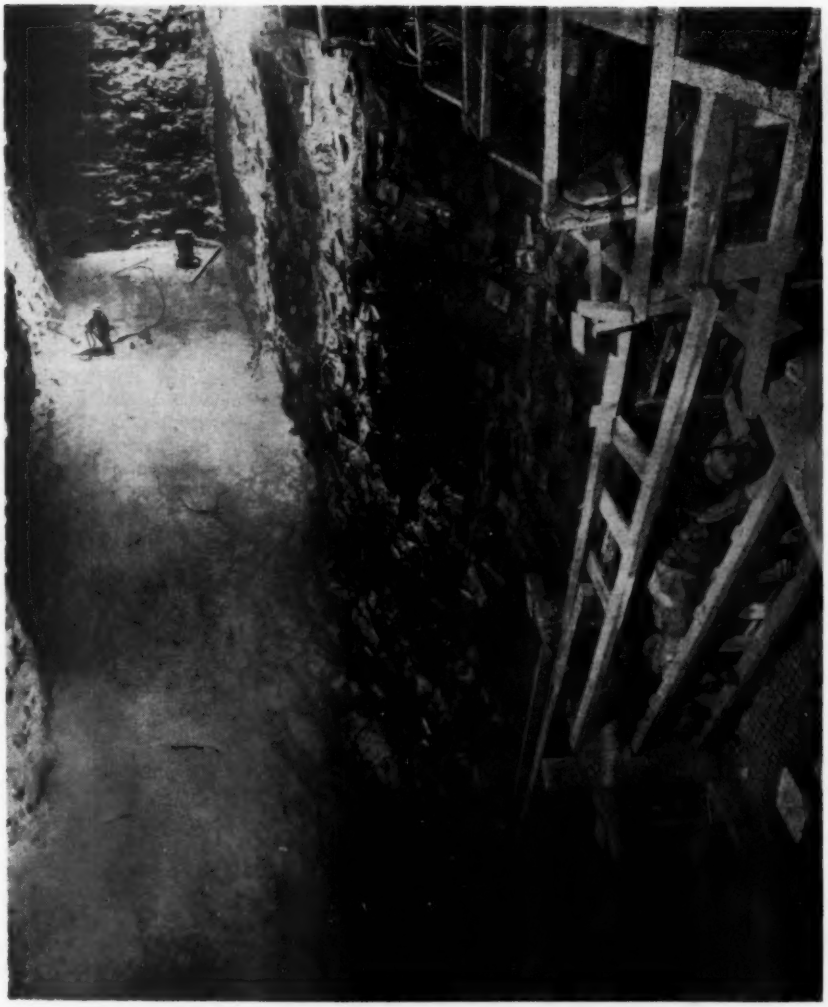
The gas utility industry has recognized the advantages of LP-gas for peak load requirements, and has a number of LP-gas installations. This table from U. S. Bureau of Mines shows sales of LP-gas to utilities since 1945.

Year	Gallons
1945	53,849,000
1946	86,660,000
1947	169,332,000
1948	237,638,000
1949	239,210,000
1950	251,694,000
1951	281,692,000
1952	259,697,000
1953	222,430,000
1954*	208,000,000

*Estimated.

The table shows rapid growth until 1951, and a decrease since then. Part of this can be accounted for by the conversion of LP-gas-air utility plants to natural gas, and by the unusually warm weather over most of the country during the winters of 1951-52, 1952-53, and 1953-54. The LP-gas industry believes there are other reasons as well, and is anxious to help in reversing the downward trend. Storage, and, to some extent, transportation facilities seem to be the bottlenecks.

LP-gas industry has a peak load problem itself during the winter period, and its storage and transportation facilities are usually taxed to the limit at the time gas ulitities reach their peak demand period. According to Bureau of Mines reports, total sales of LP-gas in December 1953 were 515-million gals as against 355-million gals in June 1954. As in the natural gas industry, areas in which house heating with LP-gas is prevalent may have a winter-to-summer sales ratio of as high as 8-1. Actual consumption rates are even more out of balance, since the LP-gas industry has encouraged the practice of filling consumer storage during the summer and fall months; in some cases by limiting contract maximums for the winter period to some percentage, such as 150%, of the amount taken during the summer period. Normally there is a lower cost of LP-gas during the summer, making it to the customer's advantage to purchase as much of his future demands as he can store during this period.



Underground chamber of mined storage for LP-gas.

Production of LP-gas is fairly steady throughout the year, or would be if sufficient storage were available during the period when sales are low. Since production does not vary nearly as much as consumption, these latter inequalities must be ironed out by adequate storage to carry excess production over into periods of high demand. Obviously, if storage of excess production occurs at or near the point of production, the bottleneck may be shifted from production to transportation. The LP-gas industry normally has an excess of high-cost tank cars and tank trucks during summer months, and can put them to good economic use only if excess production can be moved to storage in areas of maximum winter consumption. Such storage has been provided by some major LP-gas producers, especially in the Chicago area. However, much remains to be done in increasing storage volume at or near point of consumption.

This appears to be a problem that requires the attention of both producers and large volume consumers and the pooling of their information and experience should be of mutual benefit.

Conventional high-pressure, aboveground, horizontal storage has the disadvantage of relatively high cost. This estimate, based upon an installation of twenty 30,000-gal propane tanks indicates a basic cost of about $20 per barrel.

Cost for 600,000-gal gross capacity; 20 tanks @ $8,500 fob factory	$170,000
Hauling and erecting	20,000
Foundations	20,000
Piping, valves, labor	65,000
Painting, purging (if necessary) and testing	15,000
	$290,000

To this must be added such items as site preparation, engineering, contractor's profit (or overhead, if plant labor is used), product-handling equipment, fire-fighting and safety equipment, fencing, railroad spur if

LP-gas is to be received by tank car, and other miscellaneous costs, all of which may vary widely and will have to be estimated separately for each individual case. Cost for the complete installation will probably range from $24-$31 per bbl if installation is to meet all recommendations of Pamphlet No. 59 [NFPA-NBFU].

A saving of about $3.70 per bbl can be made using 125 psig storage, which is suitable for butane and some butane-propane mixtures.

Storage costs of this order, while reasonable when the storage has a good throughput rate, become a burden when the storage is filled and emptied no more than once a year.

The cost per bbl of aboveground LP-gas storage may be decreased by any of the following installations:

1. Horizontal tanks having a unit capacity in excess of 30,000-gals;
2. Large-volume vertical tanks, spheres, etc.;
3. Refrigerated storage.

In addition, other promising methods not yet fully developed or tested in service for an adequate length of time include:

1. Use of new steels, such as U. S. S. Carilloy T-1, in fabricating pressure storage;
2. Storage made from prestressed concrete cylinder pipe;
3. Storage consisting of large diameter (30" or more) pipe.

There is no particular saving in the cost per unit of volume of the tank itself. Savings in the cost of handling, foundations, fittings, valves, and piping result in a total saving of from $3-$5 per bbl for propane storage, as compared to the conventional 30,000-gal tank. In addition, there is a saving in operating and maintenance costs, due to decreased number of valves and other appurtenances.

Disadvantages of this large-volume type tanks are confined almost entirely to its movement from the manufacturer's shop to the installation area. The extreme length of these tanks, which usually exceeds 100 feet, may also rule out their use in confined areas.

Large-volume vertical storage

Tanks of this type in LP-gas service have been confined mostly to butanes, except for units in refrigerated service. The unrefrigerated tanks are usually designed for 75- or-125 psig working pressure, and have a unit gross capacity of 4,000-6,000 bbl, or 168,000-252,000 gals. They are field-erected and tested, and completely-installed will cost $14-$20 per bbl of capacity for the 75 psig working pressure sphere, $19-$24 per bbl for the 125 psig working pressure sphere.

Advantages include operating simplicity, since the number of units required for a given capacity is small, low maintenance, and a small land area for installation. Disadvantagese include the necessity for field erection, which precludes economical moving if the need should arise.

Refrigerated storage

Because of inherent operating problems, due primarily to the normal short-residence period of LP-gas in storage, the LP-gas industry has not developed refrigerated storage to any extent. LP-gas would have to be cooled going into storage and heated coming out, as customer-complaints about low pressure, icing of containers and delivery equipment difficulties would result if the product were sent to the consumer at its stored temperature. Refrigerated storage simply did not seem practical to an industry whose main source of income was from "bottle gas."

These difficulties do not exist, or at least are greatly minimized, in the storage of LP-gas for gas utility peak loads, so the question of refrigerated storage becomes one of economics. The low installation costs must be balanced against higher operating costs, since LP-gas must be refrigerated going to storage and must be held at some predetermined temperature, usually considerably lower than that of the surrounding atmosphere. In some cases, withdrawal of vapor to augment sendout gas or to supply fuel to the plant's utilities, may be preferable to a standard refrigeration cycle during the holding period.

Cost data on refrigerated ammonia storage, completely installed, are about $10.75 per bbl for a 40,000-bbl installation, and $12.50 per bbl for a 15,000 bbl installation.

The advantages of refrigerated storage for LP-gas are:

1. Low initial investment per unit of capacity;
2. Insulation becomes a safety protection in event storage is exposed to fire.

The disadvantages that may be encountered, if suitable precautions are not taken, are:

1. Steel cable of withstanding low temperatures, without becoming brittle, must be used. Such steels are readily available, but command a premium in cost of about $0.02 per lb over A-201 or A-212 steel. This, however, is much more than compensated for by the lesser weight of steel required.
2. Operating costs are higher but, because of low investment, amortization and carrying charges, may balance high operating costs.
3. Considerable time will be needed to unload incoming shipments unless large refrigeration capacity is provided. Demurrage could easily be a cost factor on rail shipments.
4. Even though weatherproofed, insulation may become water-or-ice saturated due to breathing action; then insulation efficiency falls off sharply.
5. There may be a tendency, if tank rests on ground, for the ground to freeze if not completely insulated from the tank, in which case severe strains could be set up in the storage due to expansion of the earth.

By maintaining a semi-refrigerated condition, that is, holding the temperature of the contained LP-gas not to exceed 35F, most of these disadvantages would disappear, but unfortunately so would most of the advantages.

Considering special conditions under which gas utility peak load fuel is stored, and the possibility of assisting the refrigeration cycle by continuously using some of the vapors from storage, it appears that the gas industry should take a good long look at refrigerated LP-gas storage. It probably will be necessary to emphasize the fact that liquefied petroleum gas is entirely different from liquefied natural gas.

New steels for pressure storage

United States Steel Company has recently announced a quenched and tempered plate material, Carilloy T-1 steel, which offers promise for fabrication of low weight pressure storage. The estimated cost per pound is about 2.5 times that of A-285 steel, and, as shown in this table, is considerably more than that of other steels commonly used in pressure storage.

	Approximate mill cost of firebox steel per pound	
	For atmospheric temp. application	For —50F application
U.S.S. Carilloy T-1	$0.1315	$0.1465
A-201 Grade B	.0525	.0725 (A 300)
A-212 Grade B	.0525	.0725 (A 300)
A-285 Grade C	.0465	——

To compensate for this higher cost per pound, it is necessary that full advantage be taken of these physical properties.

	Min Yield Psi	Tensile Strength
Carilloy	90,000	105,000
A-201	32,000	60,000-72,000
A-212	38,000	70,000-85,000

To utilize the new steel economically, it has been proposed to base pressure vessel design on yield strength instead of the ultimate tensile strength; to omit mandatory stress-relieving requirements and to allow higher joint efficiencies in non-stress-relieved vessels. This, of course, would require a major change in existing codes and the use of steels such as this would seem to be some time away. However, demonstrations of ability of pressure tanks, built of this new steel, to withstand excessive pressures, and impact under excessive pressure, may have far-reaching effects upon the design of all pressure containers.

Prestressed concrete cylinder pipe

Lock Joint Pipe Co., late in 1953, built a prestressed concrete cylinder pipe, 28" ID. 80' long, for a test bulk storage container for LP-gas.

No. 12 ga sheet steel, Grade B, A-245-52T, was fabricated into 16' long cylinders and, after having joint rings welded to them, were tested with water and then air to a steel stress of 25,000 psi. All welds were doubly welded to insure liquid-and-gas tightness.

Concrete, meeting Portland Cement specifications ASTM Designation C-150-52, was then centrifuged into the steel cylinder to a thickness of approximately 3". The pipe was then steam-cured at 110F for 36 hrs. The cylinder containing the concrete core was wrapped with high-tensile wire under a gross wrapping stress of 140,000 psig, and then coated with a ⅝" thickness of a cement slurry and mortar. After a second steam curing for 12 hrs, followed by air-curing for 3 days, it was given a

second prestressed wire wrapping and a second cement mortar coating ¾" thick. A final curing was then given. See Figure 1.

Various gauges and safety and measuring devices were installed in a blind steel flange, attached to a steel flange welded to a steel saddle in the center of one length of pipe.

Neoprene seals were developed for the joints, which slip together readily during installation. The joint design permits deflection of several degrees between adjacent sections without loss of seal. The ends are closed with steel bulkheads and the entire assembly placed underground. Advantages claimed for this type of storage include:

1. Lower cost than customary aboveground steel pressure tanks. It is estimated that such storage would cost $15-$21 per bbl, completely installed.
2. Very low maintenance, since painting is not required, and the steel cylinders are protected against corrosion from surrounding earth.
3. Since it is underground, temperature of stored liquid is fairly uniform, the year around, and high pressures are avoided. This also provides minimum exposure to fires, explosions, and other hazards.

Disadvantages would include the large area required for such a system, if stored volumes were large. Lack of experience prevents further analysis or comparison at this time.

Storage in large diameter pipe

Storage of LP-gas in underground pipe is in operation in at least 2 locations at pipeline terminals. These 30" tubes are approximately 1,000' long, and are grouped in batteries of 6, with each battery having a capactiy of at least 4,200 bbl. Since cost is about the same conventional pressure tanks, there seems to be no incentive to build more at this time, since they require considerably more ground area. However, there have been no operating difficulties experienced with these installations; future developments may place them in a more favorable position.

Underground storage

The storage of petroleum and petroleum products underground is nothing new, having been proposed in Germany in 1919. Original use of caverns in salt formations to store LP-gas in liquid state seems to have been made about 1949, although storage of LP-gas in depleted natural gas formations began in the '30s. Mined caverns for LP-gas storage were introduced about 1950.

The growth of this low cost method of storing LP-gas was amazing. National Petroleum Council, in 1951, appointed a committee to study underground storage of oil and its products, including LP-gas. This committee submitted an exhaustive report in 1952. At that time, there were in operation or under construction underground storage facilities, mostly for LP-gas, with a total capacity of about 7-million bbl.

The committee found that creation of cavities in salt is feasible in 5 areas in the United States; in 5 other areas suitable storage caverns would have to be mined from hard rock. More than half the country is underlaid with sedimentary rocks, such as shale, which would be suitable for mined storage caverns. These underground reservoirs were listed in probable order of choice:

1. Caverns dissolved from salt deposits;
2. Existing mines, where suitable;
3. Caverns mined from shale;
4. Caverns mined from hard rock;
5. Traps in naturally permeable rocks;
6. Natural caverns, where suitable;
7. Abandoned coal mines.

It should be remembered that the Council was concerned with the storage of nonpressure as well as pressure materials and all of the types of reservoirs named may not be suitable for the storage of LP-gas.

Natural Gasoline Association of America adopted in 1952, "NGAA Tentative Standards for the Underground Storage of Liquefied Petroleum Gas." These standards covered both salt formation caverns and mined caverns. Underground LP-gas storage usually is of one of these types:

1. Salt formations;
2. Mined caverns;
3. Sand formations.

There were approximately 150 underground storage installations for LP-gas in operation on January 1, 1955. Most of these are located in Texas, Oklahoma, Kansas, New Mexico, and Louisiana. It has been proposed to enlarge 39 of them. There were, on January 1, 1955, 16 more underground installations under construction and 26 more in the proposal stage.

As of January 1955, the underground LP-gas storage in use in states noted above had a capacity in excess of 450-million gals. Completion of underground storage under construction or presently proposed will increase this capacity to more than 700-million gals.

There is slightly in excess of 65-million gals of underground storage in use, under construction, and proposed in the northeast quarter of the United States. Some 34-million gals of this total were in use on January 1, 1955. As a basis for comparison, the State of Texas had approximately 167-million gals of underground LP-gas storage in use January 1, 1955, and an ultimate capacity of 290-milion gals.

Underground storage in northeast quarter, in use, under construction, and proposed:

State	Capacity in gals
Illinois	38,000,000
Michigan	10,500,000
Maryland	1,260,000
New Jersey	1,260,000
New York	11,550,000
Ohio	2,520,000
Total	65,090,000

Obviously, there is need for more underground storage in many areas of large LP-gas consumption.

Storage in salt formations

Underground storage of LP-gas in salt formations results in the lowest cost of all per unit volume and is the method in general use. It has limitations in that suitable salt formations are not widespread enough to permit such storage in many areas of high consumption.

Suitable formations exist in salt domes along the Gulf Coast of Texas, Louisiana, Mississippi, and Alabama and in salt beds in these areas:

1. Southeastern New Mexico, western Texas, western Oklahoma, and central Texas;
2. Central Michigan;
3. Western New York, western Pennsylvania, northern West Virginia, and eastern Ohio.

As a rule, salt domes are easier to work with, since intermediate layers of other materials are not usually found. However, satisfactory caverns have been washed out of both types of formations, and considerable experience has now been built up.

Construction and operation of underground LP-gas storage in salt formations is quite simple. Wells should be drilled and completed in accordance with the rules, regulations or practices pertaining to oil or gas wells of comparable depth. Where practical, casign should be cemented from bottom to top, but in no case should the casing be cemented less than 200' above the salt formation. Fresh water is pumped through the salt formation to dissolve a cavity. Part of the brine formed is usually stored nearby to be used in operation of the system. It is pumped into the cavity to force LP-gas out, and is forced out when gas is placed in storage. Some systems use pumps but the brine method is more common.

Salt formations at depths greater than 4,000' have not been utilized, since cost increases with depth, and certain operating problems appear when the bottom-hole temperature exceeds 100F.

Cost of underground caverns in salt formations is influenced by:

1. Knowledge available about underground formations;
2. Method which must be used to dispose of brine used to leach out salt. In some cases, brine may have market value, in others it poses a tough and perhaps costly problem.
3. Size of cavern desired. An incremental volume may be secured at practically no cost, since fresh water instead of brine may be used to recover the LP-gas. This results in about 15% increase in volume every time cavern is filled and emptied.

Costs of caverns in salt formations have been reported to be as low as $0.50 per bbl, when brine can be sold for further processing. It may be as high as $4 per bbl where formation requires considerable testing and engineering, capacity is comparatively small, and disposal of brine costly.

Mined caverns

Underground caverns are mined by conventional mining methods in shale or limestone formations. Shafts are sunk to levels of formations and rooms are mined from the shaft. Figure 2 shows chamber of a mined cavern at a products pipeline terminal.

LP-gas from the pipeline flows into the cavern through 2 lines feeding the extremeties of the cavern. It is withdrawn through a center outlet or shaft so that inlet and outlets are as far apart as practical. One pump forcing LP-gas from the cavern is of the submerged type. This terminal supplies LP-gas for a wide variety of use,

Turn to page 34—LP-GAS STORAGE

UNDERGROUND STORAGE

shows vast growth in five-year period

H. L. Fruechtenicht

Michigan Gas Storage Company, Jackson, Michigan

● UNDERGROUND STORAGE of natural gas has shown a vast growth in the past five years, statistics compiled by the American Gas Association subcommittee on underground storage reveal.

Here in brief are the highlights of the AGA group's latest annual statistical report, based on information provided by cooperating companies in late 1954.

General storage data

Maximum Gas in Storage. The volume of gas in storage on **October 31, 1954** was **1 trillion, 11 billion cu ft.** This volume has risen to 2.45 times the **412 billion cu ft** which was reported for the year 1950. There was an increase over last year of nearly **125 billion cu ft.**

Total Storage Reservoir Capacity (Ultimate Capacity). The ultimate capacity, which includes all native gas remaining in the reservoirs when storage operations were started, has increased 2.40 times for the five-year period. The volume in 1954 was **1 trillion, 859 billion cu ft** as compared to a volume of **774 billion cu ft** in 1950. This volume increased in the past year by nearly **125 billion cu ft.**

Total Output for Year Ending October 31. The nation had a colder winter in 1953-54 and the total output rose from a very low of **232 billion cu ft** in 1953 to **304 billion cu ft** in 1954. The volume has increased for the five-year period since 1950 to slightly more than **2.10 times** the 1950 figure. Inputs for the year 1954 were up about **30 billion** over last year giving a total volume of **432 billion cu ft** into storage for the year.

Maximum Day Output. The maximum day output was also considerably higher this year than the past year because of the colder winter in 1953-1954. There was an increase over last year of **1 billion, 351 million cu ft.** In comparing the volume for 1950 to that of 1954, we find that it has risen from **2 billion, 591 million cu ft** in 1950 to **5 billion, 564 million cu ft.** This volume has increased **2.15 times** during the five-year period.

Total Number of Storage Pools. To supplement the statistics on volumes of gas, a review of facilities might be of interest. In 1950 there were **125 storage pools** with **3853 active wells** in comparison to the year 1954 with **172 storage pools** with **6395 active wells.** There are also **12 pools** in the new construction category.

Compressing Stations. On the subject of facilities, it is interesting to note the number of compressing stations used for underground storage of natural gas. There were in 1950, **83 stations** with a total of

Ranking of States in Underground Storage Operations.
(MMcf)
Year 1954

Maximum Gas in Storage		Ultimate Capacity	
Pennsylvania	266,301	Pennsylvania	417,717
Ohio	190,973	Michigan	304,862
West Virginia	160,797	Ohio	292,029
Michigan	91,996	West Virginia	250,568
Oklahoma	77,798	Oklahoma	195,036
Kansas	55,062	New Mexico	119,435
New Mexico	30,475	Kansas	62,602
New York	30,240	California	58,075
Kentucky	19,965	Montana	42,068
Illinois	19,849	New York	35,900
California	18,713	Kentucky	24,833
Montana	14,388	Wyoming	23,896
Wyoming	14,313	Texas	16,640
Texas	11,859	Arkansas	7,801
Indiana	5,507	Indiana	7,073
Arkansas	2,543	Mississippi	865
Mississippi	555	Illinois	—
	1,011,334		1,859,400

Total Output Year Ending October 31st		Maximum Day Output	
West Virginia	68,764	West Virginia	1,148
Pennsylvania	59,915	Pennsylvania	1,046
Michigan	49,327	Ohio	824
Ohio	45,677	Michigan	752
Kansas	19,833	Oklahoma	468
Oklahoma	16,576	California	379
California	15,626	Kansas	238
New York	9,366	New York	171
New Mexico	6,519	Illinois	158
Kentucky	5,622	Kentucky	126
Texas	2,061	New Mexico	83
Montana	1,553	Texas	55
Indiana	1,455	Wyoming	36
Wyoming	973	Indiana	36
Illinois	410	Montana	31
Arkansas	389	Arkansas	8
Mississippi	139	Mississippi	5
	304,205		5,564

Growth of Underground Storage of Natural Gas.

	Volume (MMcf)	% of 1950 volume
Maximum Gas in Storage		
1950	412,106	
1951	546,720	132.7
1952	777,003	188.5
1953	889,138	215.8
1954	1,011,335	245.4
Ultimate Capacity		
1950	774,434	
1951	915,988	118.3
1952	1,292,321	166.9
1953	1,735,815	224.1
1954	1,859,398	240.1
Total Output Year Ending October 31st		
1950	143,435	
1951	200,435	139.7
1952	234,792	163.7
1953	232,559	162.1
1954	304,205	212.1
Maximum Day Output		
1950	2,591	
1951	3,241	125.1
1952	4,101	158.3
1953	4,213	162.6
1954	5,564	214.7

158,000 hp. This is compared with **115 stations** having **300,000 hp** in the year 1954.

Capital Investment. All this growth in underground storage operations has meant a large capital investment. The committee estimates that the total capital investment, which includes both cushion gas and plant, is **$343,000,000** for the year ending October 31, 1954.

Storage data by states

A few facts regarding storage operations in some of the leading states:

Four Leading States. There are **4** of the **17** states where storage is carried on that are the leaders in all phases of underground storage. These states are West Virginia, Pennsylvania, Michigan, and Ohio. West Virginia is the number one state in outputs both for the maximum day and for the annual total outputs. This is a change from last year when Pennsylvania led in all phases of storage operations. Pennsylvania continues to lead in maximum volume of gas in storage and ultimate capacity. Michigan and Ohio are very close behind in all phases.

Total Annual Output. For the year ending October 31, 1954, West Virginia had an output of nearly **69 billion cu ft** of gas which was the largest volume for any one state. The four states mentioned above which have most of the storage pools in the United States had a total of nearly **224 billion cu ft** or about **75 per cent** of the total.

Maximum Day Output. The four leading states in underground storage had a maximum day output of about **3 billion, 148 million cu ft,** or approximately **70 per cent** of the total of all states. The leader of these is West Virginia with an output of **1 billion, 148 million cu ft.**

Acknowledgment

This article abstracted from a report presented at the AGA Gas Supply, Transmission, and Storage Conference, Pittsburgh, Pennsylvania, May 9-10, 1955.

Hasche Gas Reformers in Florida

Florida has installed a total of 8 Hasche gas reformers to April 1955. More units are being contemplated for installation during this year.

The 1MMcf unit measures roughly 15′ x 7′. A water scrubber of sufficient capacity to handle the 40-45Mcf/hr is necessary to scrub and cool outlet gas. When producing gas lower than 675 Btu, additional equipment such as a small electrostatic precipitator is necessary to precipitate or filter gums and light oils that may have been produced. Heating values above 700 Btu require only water scrubbing and cooling.

The gas making unit is approximately 5½′ high with controls and indicating instruments located for ease of observation and adjustment. These units could be made entirely automatic, but one gas maker is kept on duty to check operation.

The control of the unit depends upon:

1. Propane vapor intake,
2. Air intake,
3. Three temperature points within unit,
4. Differential pressure across chambers,
5. Gas outlet temperatures,
6. Cycle timer (controller for reversing valve).

As example of data necessary in balancing this unit, adjustments below were obtained within units producing indicated Btu Hasche gas:

Btu of gas produced	610	710
Venturi orifice pressure (psig)	30	33
Vapor flow (cu. ft./hr)	7,700	20,000
Air flow (cu. ft./hr)	18,800	40,000
Differential pressure (" wc)	17.5	16.0
Outlet gas pressure (" wc)	10.3	—
Outlet gas temperature (F)	600	600
Temperature No. 1 (°F)	1,400	1,400
Temperature No. 2 (°F)	1,480	1,400
Temperature No. 3 (°F)	1,400	1,440
Cycle (time of contact each side) (min.)	1	1
Make/hour (cu. ft.)	40,000	80,000
Specific gravity	.89	.93

From experience, it has been found the higher the Btu of gas produced in the Hasche unit, the lower will be the temperature of outlet gas.

Impurities to be expected and removed from Hasche gas vary greatly with Btu content. Above 700 Btu one can expect only a small amount of formaldehyde with very little gums to be removed by water scrubbing. As Btu is decreased below this point there will be an increasing amount of gums to be removed by an electrostatic precipitator or by filtration through a shaving scrubber.

Interchangeability of this gas is very good with carburetted water gas. All properties with these units have experienced very little difficulty in changeover as long as they remained within the range of 50-90 Btu.

Cost of gas to customer appliances has been reduced mainly to the decrease in production labor cost.

Hasche reformed gas has been interchanged with natural gas, which is very interesting, as we can use Hasche units for peak load shaving when we get natural gas in Florida.

A Hasche gas of 1,120 Btu was distributed in anticipation of the arrival of 1,050 Btu natural gas. The changeover to natural was made with no customer knowledge of the change. There were some flame differences in the gases as Hasche gas burned with slightly harder and shorter flame.

The usual gas property where installation of the Hasche unit might be considered would already have thermometers, specific gravity recorders, water scrubbers, water pumping equipment and air compressors. Gas holders will also be available with compression units.

The approximate factory cost of the Hasche unit is given here, and the additional equipment can be added to these figures as found necessary. Foundations and changes in piping can be better figured on location.

Unit Capacity	*Approximate Factory Cost*
1,000 Mcf/day	$23,000
2,000 Mcf/day	34,500
2,500 Mcf/day	38,000

From opinions gathered among men using the Hasche unit in Florida, we have a very flexible gas production unit capable of production of gases in all usable ranges beginning at 500 Btu. This feature combined with the ranges of interchangeability make this a unique unit. Interchangeability of this gas with 1,000 Btu oil gas should be possible, but we have no knowledge of this having been tried.

After overcoming our difficulties, we are well pleased with the Hasche units due to:

Gain in manufacturing, storage, and distribution with no conversion of appliances,

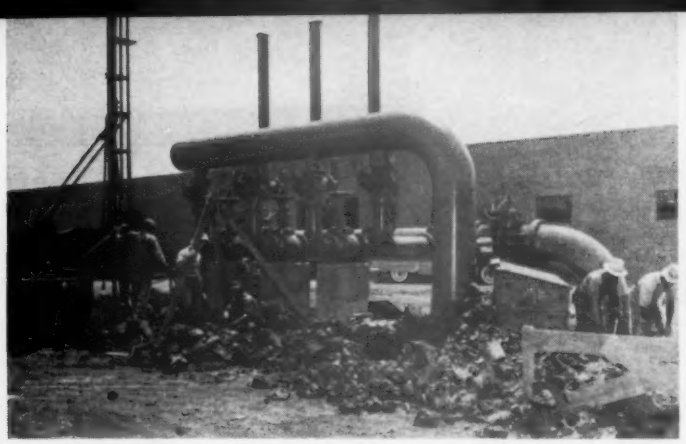
Reduction in production labor,

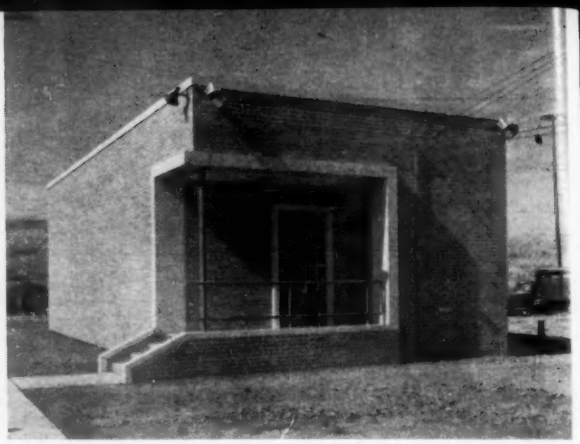
Reduction in plant maintenance,

Interchageability with manufactured gas on peak or base loads,

Possibility of an almost automatic substitute for natural gas as base load or peak shaving.

This is a condensation of a presentation by Joseph Frink, Florida Power and Light Co., at American Gas Association's 1955 chemical, engineering and manufactured gas production conference. For details, communicate with AGA Operating Section. Reference: CEP-55-11.





Left—Completed regulator station before building was erected. Right—Building's facade conforms with neighboring architecture.

Noise Abatement in Pressure Reducing Stations

Acoustics . . . sound control . . . noise abatement. There are terms that are becoming increasingly important in the planning vocabulary of gas utility engineers.

The time has arrived when the gas company engineer must be aware of sound and its pertinence to his equipment. He must be prepared to control the noise originating and emitting from various types of equipment so that it is not objectionable to neighbors.

A problem involving noise abatement in regulating equipment was encountered by

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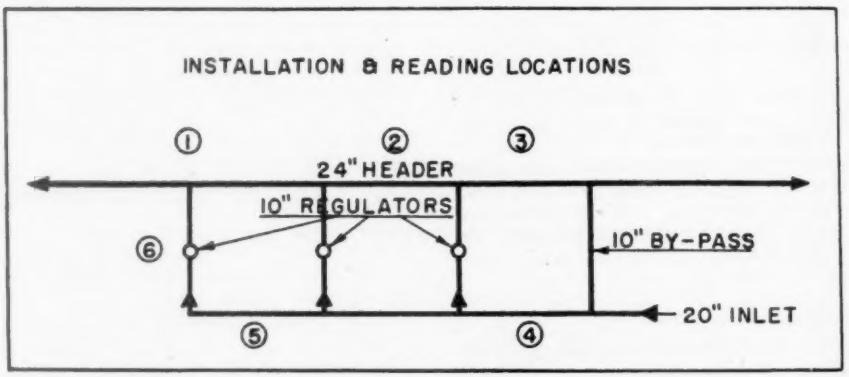
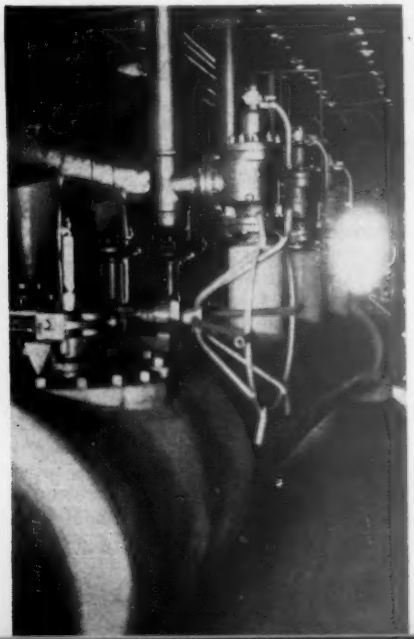


FIG. 1. Schematic drawing of station shows six microphone positions at which effectiveness of soundproofing job was measured.

Successive layers of hair and asbestos felt with asbestos cement and canvas finish-coat were applied to all piping and control surfaces.



the Dallas Division of Lone Star Gas Company in midsummer, 1952. The company planned to construct a new pressure regulating station in an area that was a rapidly growing industrial and commercial district.

All of the buildings in the area were new, of modern architecture, and most of them combined offices with warehousing operations. Lone Star engineers had determined what would be needed in the proposed pressure reducing installation, and designed the building to conform with surrounding achitecture.

They had doubts, however, about the noise problem. The deed to the property purchased contained a restricting clause covering objectionable noises. The company planned to use three 10-in. regulators to reduce pressure from 175 psi to 25 psi. This equipment, they knew, would create a large amount of noise during certain load conditions.

The building to house the pressure reducing installation and the remote recording and control equipment was designed by an outside architect. For noise reduction, blankets of 2-in. thick banacoustic were to be used on the interior walls and ceilings, covered by a metal lath to prevent damage to the blankets.

No windows were used in the building and ventilators were provided with 1-in. thick air acoustic, 6-in. on center to baffle out the sound.

After the building was completed and gas turned into the installation, the wall insulation appeared to be effective in reducing the noise, as far as the neighborhood was concerned.

As the load increased, however, the noise level increased. The three 8-in. blow-off lines had been erected through the roof and they were acting as sounding boards, providing an outlet for the sound to escape.

This problem was easily solved by fabricating mufflers, 32-in. diameter by 5 ft high, from 10-gage metal, with a 4-in. internal liner of acoustical material. These mufflers were then set over the blow-off lines.

These measures completed the sound control job exterior-wise; but it had been so effective in containing the sound that company personnel could not stay inside the building to work on equipment.

Actually, the job was not yet complete.

	MICROPHONE POSITION 1			MICROPHONE POSITION 2			MICROPHONE POSITION 3		
Freq. Band	I	II	III	I	II	III	I	II	III
30–75 CPS	80 DB	76 DB	78 DB	80 DB	74 DB	79 DB	78 DB	74 DB	79 DB
75–150	83	80	83	86	83	84	84	82	87
150–300	85	80	82	86	82	83	82	79	80
300–600	97	89	85	97	88	85	91	87	82
600–1200	101	83	82	102	84	84	99	80	80
1200–2400	105	82	83	107	80	81	103	78	79
2400–4800	103	81	80	104	78	78	100	75	75
4800–12000	94	78	75	95	76	73	90	71	68
Loudness (Sones)	612 S	223 S	207 S	638 S	200 S	195 S	547 S	162 S	155 S

	MICROPHONE POSITION 1			MICROPHONE POSITION 2			MICROPHONE POSITION 3		
Freq. Band	I	II	III	I	II	III	I	II	III
30–75 CPS	77 DB	73 DB	79 DB	77 DB	75 DB	78 DB	76 DB	73 DB	76 DB
75–150	82	80	85	83	81	85	80	79	83
150–300	86	80	85	84	80	85	88	80	82
300–600	94	86	86	93	92	88	92	89	84
600–1200	98	82	82	99	81	83	96	82	83
1200–2400	103	79	80	104	81	85	102	83	85
2400–4800	100	75	76	101	81	84	99	82	84
4800–12000	91	70	69	93	78	79	90	79	78
Loudness (Sones)	648 S	172 S	176 S	557 S	221 S	249 S	509 S	233 S	237 S

NOTE I. 10 Dec. 1952 — No covering on any of the Equipment.
II. 19 Dec. 1952 — Two layers of 1" hair felt and three alternate layers of 1516 felt.
III. 20 Feb. 1953 — As 19 Dec. with cloth and asbestos cement added.
It is felt that the difference in the data taken on 19 December an l 20 February was due to a heavier load at the time the readings on 20 February were taken.

The next logical step was to insulate the piping and equipment. After careful study of the problem, it was decided to contract with a local firm to apply successive layers of 1-in. hair felt, separated by a layer of 15-lb asbestos felt. The contract was made to allow as many layers as thought necessary to be applied, with the privilege to stop after any one layer. Application of a finish coat of asbestos cement and 8-oz canvas would complete the job.

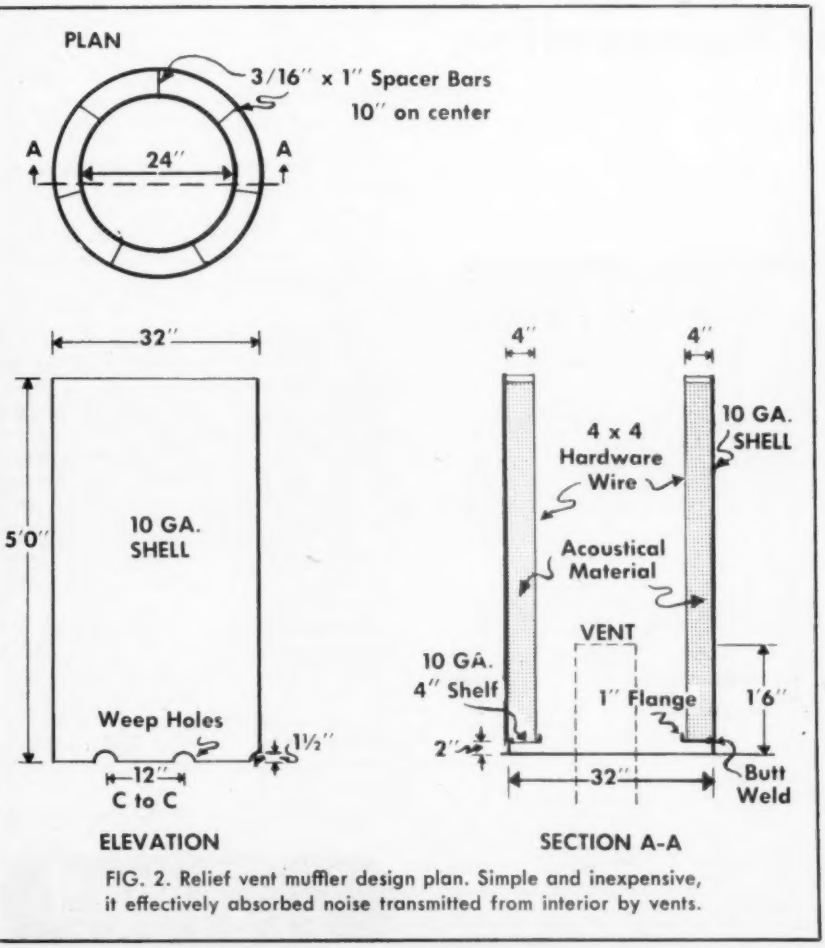


FIG. 2. Relief vent muffler design plan. Simple and inexpensive, it effectively absorbed noise transmitted from interior by vents.

To ascertain the effectiveness of the soundproofing job, readings were taken on three different days. These readings are shown in the table above. On each date, six readings were made in eight frequency bands. The readings were made in decibels representing the sound pressure level in each frequency range, with a standard decibel reference of 0.0002 dynes per square centimeter.

The loudness as shown, is in *sones*. A *sone* is an arbitrary scale based on what noise sounds like to the ear. A noise with a *sone* rating of twice another noise, sounds twice as loud.

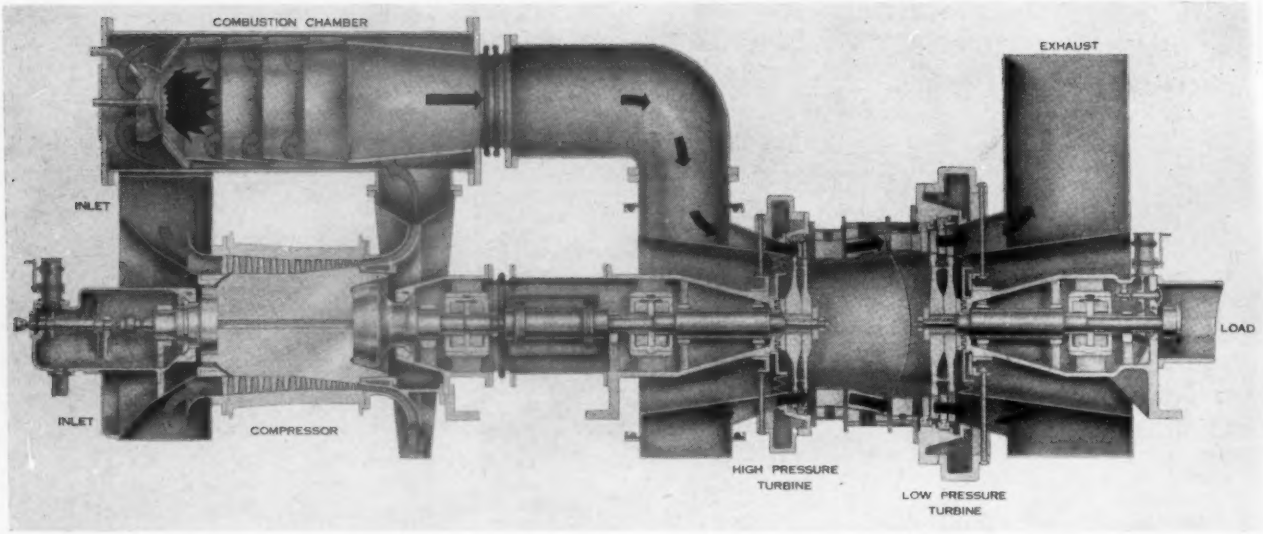
The location of the microphone used in taking the readings is shown in Fig. 1. In all cases, it was held approximately 5 ft from the floor.

Reduction of the noise in the last four frequency bands (600-12,000 cps) was the chief problem. These four bands are important because they cause loss of hearing, make it difficult to talk, and are very annoying. In these bands, the work was very successful.

This was the first experiment made by Lone Star in sound control. Since that time, another pressure reducing station has been insulated, as a result of noise complaints.

It was an existing station of standard construction and no attempt was made to insulate walls or ceilings or other portions of the building.

In this station, the treatment of using 1-in. hair felt and 15-lb asbestos felt, plus a final coating of asbestos cement and canvas, was used. Although no noise survey was made, the reduction of the sound level was very perceptible to the human ear and there have been no further complaints.



Simplified cross section shows flow of air and gas through gas turbines. Air enters axial compressor, lower left. The 13-stage unit discharges air into combustion chamber where it is mixed with fuel and burned. Hot gases enter high-pressure turbine. They turn this turbine and also the axial compressor connected to it. Next, hot gases enter low-pressure turbine, connected to the load. Gas discharges through the exhaust.

Clark Bros. Co. develops

Gas Turbine Package for Mobile-Stationary Power Generation

Adaptability emphasizes disaster . . . defense . . . utilities

● GAS TURBINE APPLICATION has been advanced significantly by direct coordination with generating equipment in a package that requires only 2 connections—fuel and transmission lines—which can be completed and operating within 24 hours after the package arrives on-site.

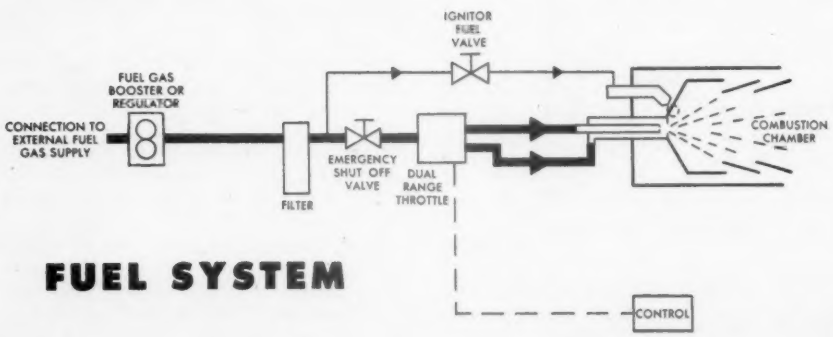
This development by Clark Bros. Co. Dresser Industries, was designed for initial use as a defense and disaster unit, built into a special railroad car. Without design change, in any particular, the package has equal adaptability for stationary installation.

J. N. MacKendrick, president, Clark Bros. Co., emphasized that while work on this project was initiated to meet an Armed Forces requirement, the program was conducted entirely with the company's own funds. No governmental funds were applied to the extensive research and developmental program.

At a maximum fuel input of 17.9 cu. ft./kwhr of 1,000 Btu gas, this gas turbine application has a maximum power output of 5,500-kw.

The gas turbine consists of an axial flow compressor and axial flow turbine with 2 shafts. The first high-pressure turbine, consisting of 2 stages, drives the axial flow compressor supplying combustion air. The second turbine, running independently, drives the load generator directly at 3,600-rpm.

Combustion air is supplied by a 13-stage



FUEL SYSTEM

American Gas Journal FEATURE

axial flow compressor at a pressure ratio of 4.25 and a flow of 100-lb/sec. The compressor is driven through a flexible coupling by the high-pressure turbine at 5,000-rpm.

The compressor case is split on the horizontal center-line, for ease of assembly and accessibility. The rotor is a 2-piece forged drum with circumferential T-grooves. Blading is designed with low loading factors for long life and high efficiency. Each rotor blade is inserted through a single slot which is closed by a locking insert. Stator blades are mounted in quarter-circular rings. The compressor rotor is dynamically balanced to assure smooth running under all operating conditions. Complete component tests are conducted on the compressor.

Combustion is accomplished in a single, high stable contraflow chamber, consisting of 2 shells that form an inner combustion area and an outer annulus. Primary air flows through the outer annulus to the end of the chamber and enters the inner area where fuel is injected and burned. Secondary air passes from the outer annulus through openings into the inner chamber where it mixes with the products of combustion. Air flowing through the outer annulus also cools the inner walls to a temperature consistent with long life. Combustion chamber liner changes are not required during the life of the turbine.

This gas turbine is designed to operate with gas or with No. 2 diesel fuel oil. No modification of the combustion chamber is needed for a changeover. Burner equipment provides for using one fuel or the other—or both at the same time.

The gas turbine

The rotating turbine blades are forged and shrouded, reducing interstage losses. The stator blades are precision cast and attached to carrier rings with controlled clearances permitting thermal expansion without strain or distortion. Tip and turbine disc labyrinth seals minimize leakage. The separate turbine design allows mounting the 2 sub-assemblies on separate bases. A flexible duct, connecting the high-pressure turbine, is removable. This area then provides access to both turbines, either of which may be completely inspected by removal of individual wheels and nozzle rings.

F. O. Hennig, who directed the development engineering of this Clark Bros. Co., compact application of the gas turbine, visualizes even further compaction and related increases in speeds as the result of their continuing development program.

Facts-and-Figures
Clark Bros. Co. Gas Turbine Generator Package

Installed in Special Railroad Car

Length of car	85′ 5″
Width of car, in transit	10′ 8″
Width of car, in operating condition	20′ 2″
Height of car, rail-to-top	14′ 7″
Weight, on track	410,000#
Car profile, Assoc. of Amer. Railroads, stand.	
Fuel consumption, full load, 1,000 Btu gas, in cu. ft./kwhr	17.9
Thermal efficiency, full load to 1,000′ alt.	19.0%
	5,500kw
Water required	0
Power rating, at 80F and to 1,000 alt.	5,500kw

The turbine is designed for normal operation at an inlet temperature of 1,350F. Excessive temperatures may be maintained for these varying percentages of operating time:

Turbine inlet temperature	Percentage operating time
1,350	100
1,375	100
1,400	25
1,425	5
1,450	1

All radial precision bearings are babbitted bronze-backed; thrust bearings are conventional Kingsbury-type.

The gas turbine-generator package, as mounted in a railroad car, has 2 independent sub-bases. One supports the compressor and first turbine; the other base supports the second turbine and generator-exciter combination. Each sub-base is supported at 3 points selected to assure minimum deflections. Relative movement, due to car deflections between sub-bases, will be readily accommodated by the flexible duct between turbines.

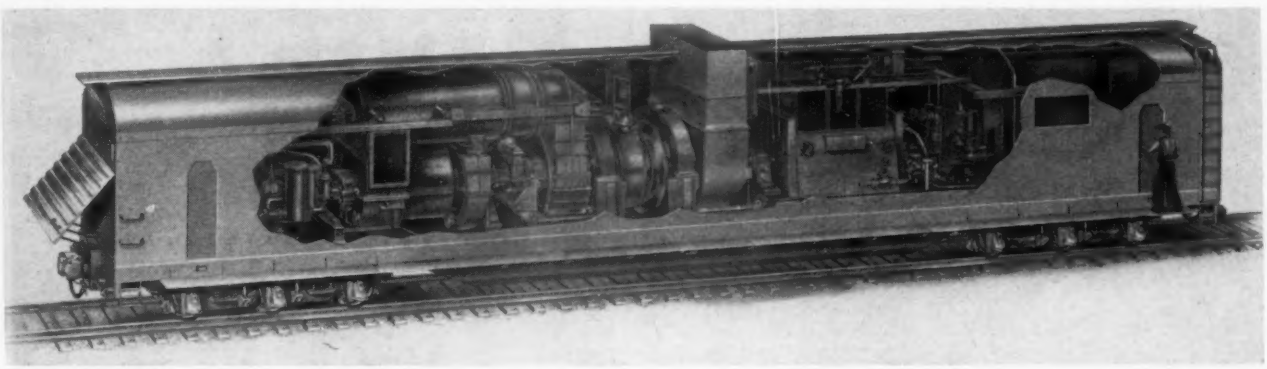
No water required

The turbines' thermo-elastic support system holds hot parts inside a cold ring. Hot components may expand and contract concentrically without influencing alignment.

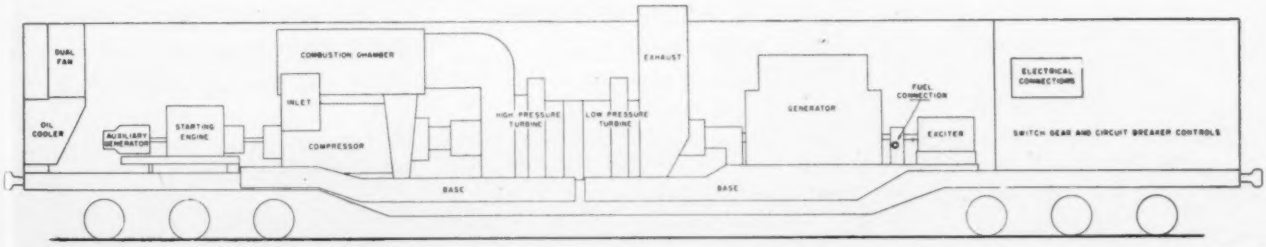
The air cooling system assures rapid trouble-free starting and stopping, maintains all supports at a minimum temperature, thereby eliminating thermal stress and alignment problems. Water is not required.

Air is introduced through openings on the inner diameter of the first stage stator ring. The cool air flows over the blade

Turn to page 48—GAS TURBINE



This cutaway shows Clark turbo-mobile power plant mounted in specially designed railway car. Opening on left end of car is for air for the lube oil coolers. Opening through roof is exhaust from turbine.



NEW ADVERTISING POWER to

SUPPLIERS TO THE GAS INDUSTRY ARE NOW DOING SOMETHING ABOUT PROMOTION

As suppliers to the GAS Industry, we're putting "cash on the barrel head" to help you increase sales of gas and appliances. With an increasing population of 38,000,000 alone in the next 15 years plus the replacement market, the Industry can make "hay" instead of losing sales to competition!

That's why we want to make sure of getting our share of the big market potential that lies ahead. The story of gas appliances must be told and retold to present and future home owners. Through advertising we'll persuade folks to look into the advantages of GAS.

And we'll keep on telling the story through the pages of the POST as an investment in more business with GAS for the years to come!

Sponsored by these suppliers to the Gas Industry:

A. C. LAWRENCE LEATHER COMPANY
AMERICAN CAST IRON PIPE COMPANY
AMERICAN METER COMPANY
CLEVELAND TRENCHER COMPANY
E. F. GRIFFITHS COMPANY
M. B. SKINNER COMPANY
ROCKWELL MANUFACTURING COMPANY
SPRAGUE METER COMPANY
U. S. PIPE AND FOUNDRY COMPANY

Under the direction of the Equipment Manufacturers Advisory Committee of the Gas Appliance Manufacturers Association, Inc.

o help you sell more GAS

Gas FITS YOUR PRESENT OR FUTURE HOME
because Gas is
MODERN
DEPENDABLE
AUTOMATIC
FAST, CLEAN
SAFE and SILENT
...and you get any degree of heat control
RANGES
REFRIGERATORS
INCINERATORS
FURNACES
AIR CONDITIONERS
CLOTHES DRYERS
AUTOMATIC WATER HEATERS
YES, Gas gives you MORE
MORE FREE TIME because now GAS is more automatic and dependable than ever before! New dream gas ranges that watch the clock and turn gas on and off while you're away are now on display.
MORE SPACE FOR LIVING with gas water heaters or heating units which can be tucked into a tiny closet. More comfort from the new air conditioners!
MORE ECONOMY, TOO! Heat water, dry clothes, or install a gas incinerator, you enjoy low initial cost, lower operating costs, more comfort and convenience...with GAS.
MORE SELECTION because only silent, safe, GAS offers all 7 – Ranges, Refrigerators, Furnaces, Clothes Dryers, Air Conditioners, Water Heaters and Incinerators.
Only GAS gives you all 7 home services
How you can have more with GAS is brought to your attention by these Suppliers to the Gas Industry:
American Cast Iron Pipe Company
Cleveland Trencher Company
E. F. Griffiths Company
Sprague Meter Company
SEE YOUR DEALER OR GAS COMPANY TODAY AND LEARN HOW MODERN YOUR HOME CAN BE WITH GAS

When you build, buy or remodel, be sure your home is modern — with
Gas
Only GAS gives you all 7 home services
because gas is modern, automatic, clean, dependable, economical, fast—
AND YOU GET ANY DEGREE OF HEAT CONTROL
AMERICAN METER COMPANY
SUPPLIERS TO THE GAS INDUSTRY

NOTE TO SUPPLIERS:
You too can participate in this important program. Write to The Equipment Manufacturers Advisory Committee of GAMA.

NOTE TO UTILITIES:
This advertisement reflects the effort of equipment manufacturers to build more business for GAS.

Free color reprints of these ads, and mats for black and white newspaper reproduction, with space for your company signature, are available upon request.

Industrial and Commercial Gas Sales Conference

AMERICAN GAS ASSOCIATION

G. R. VanKampen . . .

sales manager
Red-Ray Manufacturing Co., Inc.

. . . said

In production of textiles and paper, processes requiring heat are principally drying, and setting or curing. Both textiles and paper can be damaged by heat, or even burned; temperatures must be sufficiently high to provide efficient drying or curing at profitable speeds. Temperatures which may be safely used and volume of heat required vary greatly with different materials, processes and conditions.

In drying completely saturated cloth or paper, percentage of moisture is so great that high temperatures may be safely applied during initial stages of drying. Heat of evaporation is such that the material will not reach a high temperature. As percentage of moisture is reduced, temperature to which the material is subjected must also be reduced.

In curing special finishes on textiles it is necessary to first dry the material, then it must be subjected to controlled temperature, usually something between 325-and-375F. Too low a temperature will result in unsatisfactory curing; too high a temperature can damage the material. In many artificial fabrics, fibers will actually melt.

Gas makes possible the use of high temperatures, where desirable, for high speed processing, or accurately controlled lower temperatures where required. Selection of gas burning equipment and methods of applying it are of extreme importance if maximum results are to be obtained. Too often one type of burner or one method of applying heat is used, where varied burners and methods would be more efficient.

For some processes, steam is desirable though often used where correct burners and controls could accomplish results more efficiently. Where it is available and cost is competitive to other fuels there is little argument as to advantages of gas. Under certain conditions small gas-fired boilers for scattered processes would provide greater flexibility and economy.

Frequently steam is used to heat vats and tanks where immersion burners or underfiring would be more efficient. There are many cases where burners used in this manner have made it unnecessary to operate large central boilers. The saving in labor cost by not operating the central boiler can be very substantial. In some instances this has resulted in installation of gas heating equipment in mill offices for off-season heating, when heat is not required in manufacturing.

Following are the more general uses of heat in textile mills:

Calender rolls are widely used in textile mills. Formerly heated by steam, it is now becoming general practice to heat by gas burners. Rolls are usually 12"-to-14" in diameter, with thick walls, leaving inside diameter of only 6"-or-7". Ribbon burners meet requirements excellently and provide additional heat for increased production.

The slashing process, used in many textile mills, involves application of sizing to individual warps, subsequently woven into finished goods. Sizing is usually applied by passing warps through tank containing sizing material. Coating must then be dried.

Ovens are used for a variety of drying processes, curing special finishes and setting special materials such as nylon and glass cloth. Gas offers so many advantages that mills are rapidly turning to gas. High speed drying requires efficient delivery of hot air to material but also maximum temperatures in various phases of the process. Accurate temperature control and varied temperatures in different zones can be provided.

While many burners are available for textile ovens, it is often advisable to give careful consideration to combustion characteristics. Incompletely burned gas may affect some colors and fabrics. Small gas-fired preheaters are sometimes used just ahead of ovens. These preheaters operate at higher temperatures than oven itself. Radiant gas burners are often used as preheaters.

Tenter frames, open or enclosed, are important in textile finishing plants. The enclosed frames are in effect long ovens through which the cloth makes a single pass. Heated air is the general medium of heat transfer. Heat must be delivered to goods very rapidly.

A large volume of cloth is processed on open tenter frames. It is necessary to transfer large amount of heat to material in limited time and space. Steam coils cannot provide drying speeds necessary for modern conditions. Attempts are made to use electricity as a source of heat. Infra-red lamps or various resistance-type heaters are used.

When heaters are used directly, hot, moist air resulting from drying process creates extremely unfavorable conditions for electrical equipment. The energy cost is high, usually several times that with gas.

Singeing is in no sense a drying process but it is an important operation in textile finishing. Fuzz or protruding fibers, and in some cases hairs, must be removed. Brief exposure to intense heat gives desired results. Gas is widely accepted for singeing and its use for this purpose is becoming more universal.

Nylon setting has become an important operation. The basic requirement is ad quate heat, with accurate control of temperature. Methods of applying the heat differ. Regardless of method of applying heat, temperatures available and close temperature control, make gas burners ideal for nylon setting.

Paper must be dried as it is made and then much of it must again be dried after it is coated or otherwise processed. A paper machine includes a number of steam heated rolls, over which paper passes for drying. Fuel used for generating steam is largely a matter of price. In areas where natural gas is very cheap it is used to fire boilers, but it would be foolish to attempt to sell gas for this purpose in most Northern states. Auxiliary drying by hot air, the direct application of burners, or both, often increases production by 10-to-15%. Cost of gas fired air heaters or burners for direct use is low in comparison to cost of machine; cost of gas is far less than profit on additional tonnage.

In each case there is gas equipment to meet the specific requirements of the process. Don't attempt to use one type of burner for all processes. Choose the correct tools. Use gas where it offers advantages. The results can readily justify cost of fuel.

Hermann Gehnrich . . .

president
Gehnrich & Gehnrich, Inc.

. . . said

The basic application difference between the homeliness of the batch type oven, and the glamour of the continuous unit, is vested only in production requirements or material handling. The problems of process heating are essentially the same in either case, taking into account only those differences involved when we feed production into a unit a little at a time, as against handling a batch of a product all at once. By definition, the batch type or box oven, is an insulated enclosure in which a batch of work-load is put for processing.

Turn to Page 37—SALES CONFERENCE

Old Days Recalled . . . from

AMERICAN GAS JOURNAL

EST. 1859

90 YEARS AGO

JULY 1865

COMPRESSING APPARATUS. *An improved apparatus, by means of which atmospheric air or gases may be compressed . . . to a far greater degree than has yet been accomplished by other means . . . has been provisionally specified by Mr. T. Coughin, of Bermondsey. He proposes a succession of pumps . . . the diameter of the first pump larger than the second, and the second larger than the third, in order to compensate as far as possible the power required to actuate each according as the air or gases are more and more . . . compressed in each. The pumps are to be . . . turned by hand or steam-power.*

JULY 1865

HYDRO-CARBON ILLUMINATING GAS. *The invention of Mr. W. Henderson, of Valparaiso, consists in the introduction of dry steam to the retorts containing the coal or other substances, heated to their own intensity, and in preventing any reduction of the temperature during the process of making the gas; by this means he obtains an illuminating gas, consisting of a combination of the hydrogen of water with the volatile carbon of coals, Cannels, and oleaginous substances.*

JULY 1865

NOTICE. *The undersigned would inform those about erecting works or fitting up old Benches, that he has had many years experience as mason, in building and fitting up Benches, and that he will attend to all orders from any part promptly, and offers for Reference Joseph A. Sebatton, Engineer of the Manhattan Gas Company. P. H. Spelman, 242 Third Avenue, New York City.*

JULY 1865

RESTORATION AT THE SOUTH. *We find among the earliest objects of restoration at the South, that the repairs of the Gas Works are considered, and many inquiries are made in reference to late improvements . . . In our last volume the subject of Wood Gas was treated upon, although much may yet be developed in apparatus and co-operating hydro-carbons to advantage. Generating gas from petroleum oil, is now favorably considered . . . and a system will soon be presented . . . which from our observation, is an excellent one.*

JULY 1865

MR. EDITOR—*It may be deemed an unreasonable question in the minds of some of your utilitarian readers for me to ask, why do the various Gas Light Companies . . . preserve such perfect and cautious silence upon all questions of scientific developments . . . Why are the secrets of each laboratory kept hermetically sealed within its own walls—nor even a scintillation given by which inquiry may be enlightened by experiment? In every other department of human knowledge . . . as truth spreads it becomes stronger, and the general wealth of knowledge is increased by the efforts of its votaries . . . Sir, I challenge you to produce one single article emanating from any Gas corporation, or . . . from any of its officers . . . But, sir. be it understood, I would not hold you in any manner responsible . . . for I am rejoiced to be able to testify to the earnest industry you have exhibited in culling from every source within your reach, every fact that tends to the advancement of the specialty to which you are devoted. I do not complain that your paper is not interesting—that would be unjust for it is fully equal to its profession—but I do complain that those whose positions are such that they can and ought to give additional interest, have not done so. In the hope that this condition of things may not last, I am, Yours, &c.,* SORITIA. *Chicago, July 12th.*

50 YEARS AGO

JULY 1905

H. MUELLER MANUFACTURING COMPANY has formally opened its Eastern Division in the commodious quarters as Nos. 254 to 256 Canal Street, New York city, and is now extending invitations to its friends in the gas, water and plumbing trades to visit its sumptuous new business place.

JULY 1905

THE ANNUAL MEETING of the Louisville (Ky.) Gas Company will be held to-day. It is more than likely no change will be made in the present management, especially when one remembers that those in custody of the Company's affairs are running it on a perfectly successful mutualization basis.

JULY 1905

MR. WILLIAM H. ALLDRED, for many years Secretary and Treasurer of the Equitable Gas Company, of Pittsburgh, Pa., died at his home in that city the morning of the 16th ult. Deceased was born in Pittsburgh . . . and in that city all of his useful life was spent.

JULY 1905

THE NEW SELLING RATE at Dallas, Tex., became effective the 16th ult. It is: Gross, $1.35; net, $1.25 per 1,000. Manager Mockett is busily engaged in extending the main system.

JULY 1905

AFTER MUCH DISCUSSION the Directors of the Columbus (O.) Gas Light and Heating Company have decided to keep the artificial gas making plant in action for the ensuing year.

JULY 1905

THE MARKET for city gas shares was not marked by anything that would indicate grave changes as to values since last time of chronicling.

JULY 1905

GENERAL JAMES A. GARY has resigned from the Board of Directors of the Consolidated Gas Company, of Baltimore, Md.

JULY 1905

MR. GODFREY L. CABOT, writing from Boston, Mass., under date of the 11th inst., says: I have read with very great interest the very well thought out paper of Irvin Butterworth in your issue of the 10th inst., and heartily concur with him in his views as to the condensation of water from gas lines.

JULY 1905

IN SPITE of the injunction restraining further interference with the Public Service Corporation work of laying gas mains in the village of Ridgefield, N. J., 3 more arrests of Public Service Corporation men were made. The injunction was served and then the men tried to dig up the street. Patrick Wren has been arrested 7 times already in connection with the attempt.

JULY 1905

THE CITY CHEMIST of Buffalo reported a deficiency in the quality of the gas furnished by the Buffalo Gas Company during the past six months. For this reason the sum of $514 has been deducted from the gas company's bill, which amounted to $4,764.

25 YEARS AGO

JULY 1930

HOUSE INSULATION *is making it easier to sell gas for house heating, according to J. P. Leinroth, at the New York Regional Sales Conference.*

JULY 1930

SOUTHERN GAS ASSOCIATION, *under the able leadership of President D. H. Levan held its Twenty-second Annual Meeting, with something over two hundred gas men in attendance, in Savannah. Major Alexander Forward, Managing Director, A. G. A., addressed the group.*

JULY 1930

SOUTHERN CALIFORNIA GAS COMPANY *increases appropriation for extensions . . .* WORK STARTED *on natural gas line from Texas to Indiana . . .* WILEY F. CORL *elected a vice president of The United Gas Improvement Company . . .* F. J. SCHAFER *and William Moeller, Jr., elected vice-presidents of Southern California Gas Company.*

Price Indexes: Gas, Other Fuels and Electricity

(1947-1949 = 100.0) Source: Bureau of Labor Statistics, U. S. Department of Labor

	1955				1954									1953
	Apr.	Mar.	Feb.	Jan.	Dec.	Nov.	Oct.	Sept.	Aug.	July	June	May	Jan.	Jan.
GAS														
Space heating	119.5	119.6	119.2	117.3	116.4	115.7	115.5	114.6	114.5	114.4	114.3	114.5	113.6	108.9
Non-space heating	112.2	112.2	111.3	111.1	110.6	109.8	109.7	108.8	108.8	108.9	108.8	108.9	108.8	106.4
Natural														
10 therms	101.7	101.5	101.4	101.0	100.9	100.6	100.5	99.4	99.5	99.9	99.7	100.0	100.0	98.3
25 therms	116.2	116.3	116.1	115.8	114.8	113.9	113.7	112.3	112.2	112.5	112.3	112.6	112.2	108.9
Manufactured														
10 therms	111.5	111.5	111.2	111.2	111.1	109.5	109.5	109.5	109.4	109.2	109.4	109.4	109.4	106.9
25 therms	110.8	110.8	110.6	110.6	110.5	110.3	110.3	110.3	110.2	109.4	109.6	109.5	109.6	107.8
Mixed														
10 therms	105.2	105.2	96.4	96.4	96.4	96.4	96.4	96.4	96.4	96.4	96.4	96.4	96.4	96.2
25 therms	102.2	102.2	100.4	100.4	100.4	100.4	100.4	100.4	100.4	100.4	100.4	100.4	100.4	100.0
All types combined														
10 therms	108.5	108.3	106.6	106.4	106.3	105.6	105.6	105.0	105.1	105.2	105.2	105.3	105.3	103.5
25 therms	116.1	116.1	115.8	115.5	114.7	113.9	113.8	112.7	112.6	112.7	112.6	112.8	112.5	109.6
ELECTRICITY														
Composite	105.8	105.8	105.8	105.5	105.5	105.5	105.2	104.9	104.8	104.8	104.5	104.5	103.8	104.4
SOLID FUELS														
Bituminous—All sizes combined	119.6	120.4	120.4	120.4	120.2	119.9	119.4	118.7	117.9	117.4	117.2	117.2	120.7	119.8
Anthracite—All sizes combined	129.6	131.2	131.2	130.9	129.8	129.2	128.5	126.5	126.4	124.7	124.1	123.1	135.0	135.9
PETROLEUM														
Fuel oil No. 2	125.1	125.0	125.0	125.0	124.2	121.2	121.0	118.8	118.5	117.7	117.7	118.1	121.9	116.6

Sales Indexes: Gas and Electricity

To ultimate consumers

Seasonally adjusted (1947-1949 = 100.0) Sources: American Gas Association and Edison Electric Institute

	1955					1954									
	May	Apr.	March	Feb.	Jan.	Dec.	Nov.	Oct.	Sept.	Aug.	July	June	May	April	March
Gas	188.2*	195.5	212.5	216.9	206.0	198.3	195.7	190.0	171.7	178.8	180.6	180.2	176.2	174.9	183.2
Electricity	192.5	190.2	187.1	184.0	180.1	178.7	175.0	175.9	173.1	175.6	177.7	174.6	168.6	164.8	162.1

* Preliminary.

Shipments: Residential Appliances

(000 units) Source: Gas Appliance Manufacturers Association

	1955				1954										
	May	Apr.	March	Feb.	Jan.	Dec.	Nov.	Oct.	Sept.	Aug.	July	June	May	Apr.	Jan.
Ranges															
Gas	175.1*	181.6*	217.3	186.2	152.9	145.7	174.0	197.1	203.9	179.4	134.5	174.3	163.8	172.4	137.0
Electric	—	124.1	148.8	145.4	156.2	97.2	90.7	96.4	113.8	86.8	91.4	98.1	94.5	106.0	116.4
Water heaters															
Gas	230.4*	245.2	263.1	214.7	200.0	166.8	179.1	202.0	205.5	207.1	190.3	206.7	195.6	200.8	164.4
Electric	—	76.9	84.9	75.4	62.4	49.4	57.1	63.7	80.4	66.1	66.6	73.0	69.8	70.0	53.9
Furnaces, gas	66.9*	62.6*	53.7	47.7	50.7	50.3	64.3	79.0	82.0	75.4	53.1	57.3	49.9	43.6	31.0
Boilers, gas	5.9*	4.9	5.0	3.7	3.7	Note †	7.0	10.8	10.9	8.9	6.0	6.2	6.0	4.3	2.9
Conversion burners	12.4*	9.5	7.4	6.4	5.2	9.2	16.0	32.2	35.9	29.4	19.9	19.7	22.5	14.7	8.8

* Preliminary totals. † GAMA is reevaluating all 1954 data on boilers.

Index of Yields: Selected Utilities Stocks

Expressed as percentages

	1955			1954											1953
	June	May	April	Mar.	Feb.	Jan.	Dec.	Nov.	Oct.	Sept.	Aug.	July	June	Jan.	Jan.
Transmission companies	4.24	4.13	4.04	3.94	4.01	4.25	4.27	4.40	4.40	4.17	4.17	4.25	4.04	4.21	4.04
Transm. and distrib. companies	4.83	4.78	4.80	4.91	4.87	5.00	5.08	4.69	4.70	4.61	4.67	4.88	5.01	5.39	5.02
Manufactured & mixed companies	4.71	4.79	4.71	4.72	4.48	4.57	4.88	4.72	4.38	4.16	4.26	4.36	4.45	4.66	4.87
Class "A" electric companies	4.38	4.34	4.25	4.36	4.07	4.13	4.20	4.37	4.46	4.36	4.31	4.31	4.60	4.92	5.08
Class "B" electric companies	4.62	4.63	4.57	4.60	4.55	4.68	4.72	4.69	4.77	4.74	4.70	4.78	4.83	5.14	5.19

This is a straight arithmetical index of comparative yields obtainable on selected gas and electric utility common stocks. The companies comprising this index were selected by AMERICAN GAS JOURNAL as providing a cross-section of each industry. No effort has been made to weight the average to give effect to changes in capitalization or in dividend rates because yields afforded on issues reflect such changes. The index is designed to show rate of return and not necessarily market movements of stocks comprising it. Index is compiled from: transmission companies, 5; transmission and distribution companies, 5; manufactured and mixed gas companies, 4; class "A" electric companies, 4; class "B" electric companies, 5.

Favorable Business Climate Now Seen To 1957 With Soft Spots No Menace

By John F. Falvey
Financial Editor

● RECENT ACTION of the security markets has been most favorable. The bond market has been improving gradually and all segments of the stock market have been giving a good account of themselves, thanks to optimistic predictions as to trend of business and to continuing heavy corporate expansion outlays.

Not much has been said, however, of another development, which must be given a fair share of credit for firming share prices recently. That is the internal accumulation of corporate cash, or "cash throwoff," which now is at an all-time record high level. Corporate throwoff this year is estimated currently in the order of $34-billion, which would be a gain of 20% above the amount raised from this source 5 scant years earlier. Two-thirds of the gain is being accounted for by sharply increased depreciation reserve accruals, which for 1955 are expected to approximate $14-billion, or nearly twice the $7.8-billion in 1950.

According to predictions of leading economists, depreciation reserves will continue their sharp rise for another year or so, and then level off somewhat into a more gradual rate of gain. As a basis for this favorable forecast they cite the very high level of new plant expenditures still being made by industry; accelerated amortization of defense facilities anticipated to hit a peak next year or in 1957 and then drop off; and higher rates of depreciation being charged against new assets under provisions of the Revenue Act of 1954. This last-mentioned factor is expected to mitigate any adverse effect of the cutback in depreciation or amortization of defense facilities, starting 2 years hence.

How important is this matter of depreciation may be gleaned from the fact it is accounting for almost twice as much as the amount of profits retained by corporations after divided payments. In 1956, furthermore, it might well contribute an even greater share of the corporate cash throwoff, which in turn is having a 2-fold beneficial effect. In addition to improving the quality of corporate equities, it also is adding considerably to the dividend-paying possibilities of the nation's business.

In the past year, for instance, corporate working capital increased by an estimated $3,200-million to a new peak level of nearly $96-billion. Granting corporate business activity and profits for 1955 at the level now envisioned, this should permit dividend distributions for this year to pass $10-billion, for the first time on record.

Dividends now being paid are equal to just about half the amount of earnings available for the purpose. This is a very conservative payout. With cash resources being so sharply increased through depreciation reserve accruals, many corporations should be able to increase distributions to shareholders even if earnings should slump somewhat. This probability of sustained and possibly higher dividends is being given recognition in the dwindling yield on industrial company equities, on which the return recently dropped below 4%.

With increased corporate liquidity promising probably higher dividend payments, even with a profits cutback, investors are becoming increasingly willing to accept a current low yield in the prospect that dividend payments will be higher later on.

Optimism toward the outlook is generally shared by economists and investors alike; most economic indicators show that business has rebounded strongly from the dip during the final half of 1953 and through the initial half of 1954. While there is evidence of some weak spots in the business picture and other dangers might arise in the future, it is conceded that a serious reversal of the general business trend is unlikely and all indications suggest that calender 1955 should be the best business year on record.

Admittedly, the present rate of automobile output may not continue throughout the year. Vigor of the business recovery since last fall has been due in large measure to an abnormally high level of new car output, ably aided by earlier-than-usual introduction of new models and favorable public response to the changes. This development suprred demand for steel, rubber and other vital raw material needs by the car industry.

Construction peak may be near

Sight should not be lost, either, of the possibility that the present high level of residential construction may slip somewhat over early future months. In some areas the supply of housing units seems to be catching up with demand. Labor costs are rising sharply both with respect to wage rates and to fringe benefits; the private debt situation contains some elements of possible danger. At last report, for instance, total personal debt per capita had increased to $985 for 63% of per capita disposable income of $1,556. This compares with total per capita personal debt of $779, or 53% of per capita disposable income of $1,464 in 1951.

A rise in unemployment, and/or possibly a drop in the willingness of individuals to continue their present high rate of spending and borrowing, conceivably could spark a contraction in business activity—as could uncontrolled credit inflation in the mortgage and installment fields.

The industrial and financial indices continue to point upward, albeit at a more gradual rate than heretofore. This trend may well continue to the point where business activity, some time in the months ahead, may remain at a level close to or at the present figure.

Underlying strength to continue

Pessimism is not in order, nor is undue optimism recommended. But business managers are cautioned to watch developments carefully as they chart their plans for expansion and financing, pending clearer delineation as to whether activity in other lines is sufficient to sustain the present rise in business activity, in the event the rate of output in auto, steel and construction lines should slacken.

The underlying strength of the economy is expected to continue through next year, with a high level of total construction indicated, even if residential building declines. Road building and the high-and-rising level of business capital outlays for expansion and improvements are expected to provide necessary support. Consumer spending, by reason of tax reductions, is likely to be increased.

The impact of so-called peace discussions between the East and the West insofar as it relates to the business outlook is appraised by William R. Biggs, of Bank of New York. Even though real progress may be reported by the year-end, he does not expect defense expenditures to be much below the current $40-billion. Because of administrative difficulties and the very nature of the program, the Bank of New York economist deems it "nearly impossible" to reduce expenditures substantially by the 1955 year-end. Furthermore, such reduction is based on the unlikely assumption that the Administration might wish to pursue such a course of action. However, as a result of discussions about possible progressive disarmament, some reduction in expenditures for national security might come about some time in fiscal 1957.

The forthcoming 1956 national elections, in the opinion of Biggs, should find both major political parties pledged to tax reductions, and these cuts probably will be greater than those in prospect without the also so-called "peace" background. Thus, a major lessening of tensions arising from the cold war should lend additional impetus to further tax cuts next year. Any near-term reductions in defense expenditures are expected to be more than offset by tax reductions.

An improvement in confidence, in convertibility of foreign currencies and in foreign trade also would accrue from an abatement of world tensions. This improvement in international conditions could be a major factor in the outlook for business.

Over the near-term, Biggs looks for a moderate decline in buiness for the third quarter. Resulting from some over-production in the automobile industry, it should be cushioned by an increase in capital expenditures and by a high level of consumer spending.

"Because of the upward trend of these expenditures and the outlook for tax reduction," he states, "the prospect for 1956 still seems favorable, and the lessening of cold war tensions should by no means be a negative factor."

American Gas Journal FEATURE

Gas Company Held Liable For Damage

By Leo T. Parker
Attorney at Law

EXECUTIVES AND EMPLOYEES of gas companies seldom have the opportunity to review new and simplified law suits. Obviously, numerous gas companies have exrienced financial losses because officials and employees did not know enough elementary law to enable them to avoid liability.

The purpose of this article is to review recent court cases involving points of law in which all gas company officials are interested. In the past, inquiries have been received from officials of gas companies as to rights and liabilities about performing blasting work and concerning operations when laying gas mains. Last month a court rendered an important decision which considers all phases of the law on this subject.

First, it is important to note that this court held that a jury is not bound nor obligated to believe testimony given by any person, including an expert in suits involving blasting operations.

For illustration, in East Tennessee Natural Gas Co. v. Peltz, 270 S. W. (2d) 591, suit was filed against a gas company for the alleged destruction of a concrete dam caused by blasting operations conducted upon the right-of-way of the gas company.

The testimony showed that the gas company's contractor set off a dynamite blast about 1,500 feet from the dam. The explosion destroyed the dam, which cost Peltz several thousand dollars to construct. Peltz sued for damages. During the trial a professor of seismology testified that he made an examination of the dam and the terrain between it and the pipeline. He found that the elevation of the pipeline at its nearest point was 35' higher than the top of the dam, and in answer to a hypothetical question testified that the blast under the conditions then existing could not possibly in any way have produced any damaging effects to the dam; that the vibrations from the blast at the dam would be only .003 of an inch. He stated that in his opinion the disintegration of the dam was caused by internal failure as evidenced by a large number of fragments he examined showing insufficient strength to hold themselves together. The jury refused to believe this testimony and held the gas company liable, saying:

Jury must determine credibility

"Under these circumstances, it was for the jury to determine what weight and credibility it would give to the test made by the professor, since, from all the evidence bearing on the test, the jury could draw different conclusions. Where there is a conflict between expert or scientific testimony and testimony as to facts, the jury must determine the relative weight of the evidence."

An argument presented by gas company officials was that the company could not be liable because the right-of-way deed which Peltz gave to the company contained a clause to the effect that the latter could do all blasting necessary to lay the pipeline.

Peltz introduced testimony that an agent for the gas company spoke to him about getting a deed or right-of-way through his land for the line. The testimony showed that this agent said: "I guarantee we will destroy nothing for you; the only difference will be that we are going to cut the timber on the area. We'll put the dirt back, level it up, and you can't tell the difference in it now and when we get through." After the agent's assurances that the dam would not be damaged by the construction of the line Peltz and his wife signed the deed, and he was paid $16.17 by the agent.

The Court said: "Nor do we find any merit in the defendant's (company's) contention that even though they damaged the plaintiff's (Peltz's) dam, they would not be liable in the absence of negligent or excessive blasting because they were entitled under the right-of-way deed to do such blasting as was reasonably necessary. Where a landowner suffers damage as a result of the condemnation and use of his land, which neither he nor the condemnor contemplated at the time of the condemnation proceedings, the landowner may be compensated for such damage in a subsequent action."

Law of condemnation

Gas companies, whether owned by municipalities or private corporations, find it necessary for various purposes to purchase or condemn private property. Condemnation proceedings, or the power of appropriate, is based upon "necessity" for the public good. In other words, the courts recognize that all private property is held subject to use by the public when the public good requires it. It would be unjust to the public that it should be compelled to pay the landowner more than a fair compensation for land appropriated for the "general" good of the public.

Considerable discussion has been heard regarding the proper method of determining the exact amount of damages which may be expected by the owner of condemned private property.

It is well settled law that if an owner of private property refused to sell his land to a gas company for public uses, the company may appropriate the property and pay a reasonable amount for it.

In every instance, it is the public interest, and not the private interest, that is important, and which gives rise to the extraordinary right of eminent domain. Because of this public interest, the courts will not permit an owner of private property to compel a gas company to pay more than a reasonable price for the appropriated land. Moreover, the reasonable value must be determined by present circumstances and not by speculative methods or likelihood of increased value, or uncertain losses.

In Yagel v. Kansas Gas Co., 291 Pac. 768, the owner of private property endeavored to compel a gas company to pay an unreasonable amount for appropriated land based upon the injury likely to occur in addition to the actual value of the land. The court refused to hold the gas company liable for an amount greater than the actual present valuation of the condemned land, and said:

"The law will not permit mere speculative elements of damages, based upon an ill-defined fear that at some indefinite time in the future a misfortune may come to some man by reason of such improvement, to enter into the consideration of those who, under the law, are required to fix the amount of the damages."

Jury trial is allowable

Considerable discussion has arisen from time to time over the question: If a gas company condemns private property for its public use, can the property owner demand a trial by jury to determine the amount the company must pay for the condemnation land?

Last month a court answered this question in the negative, if the State's laws do not clearly provide for a jury trial.

In Michigan Gas Storage Co. v. Gregory, 67 N.W. (2d) 219, the testimony showed: The Michigan Gas Storage Co. sought easement rights by condemnation to lay a gas main across private property. A public hearing was held before 3 commissioners who fixed allowable damages. The award, confirmed by the probate court, was appealed to the circuit court and asked for a jury trial to determine the amount of damages.

Since the state laws do not disclose a legislative "intent" to provide for a trial by jury as to necessity for condemnation and damages resulting therefrom, the higher court held that appellant must accept the amount of damages fixed by the commissioners.

American Gas Journal FEATURE

FEDERAL Power Commission

United Authorized in 9 Direct Industrials

United Gas Pipe Line Co. has a certificate authorizing it to render direct service to 9 industrial consumers in Mobile County, Ala.

United now delivers and sells natural gas to Mobile Gas Service Corp., which resells part of it to the 9 industrial consumers. The new authorization eliminates the intermediate sale to Mobile, without altering the physical means of delivery to the industrial customers. United will now deliver the gas to Mobile, which will transport it to the industrial customers, collecting a transportation charge of 2 cents per Mcf.

In another action, United was authorized to construct tap and metering facilities on an existing line near Vicksburg, Miss., to deliver gas to Port Gibson, Miss., for resale to the town residents.

Cities Service Schedules Ruled Properly Rejected

The chief presiding examiner has ruled that rate schedules filed by Cities Service Gas Producing Co. were properly rejected last October by the FPC Secretary, as not in conformance with the Commission's rules and regulations.

The decision, subject to review by the Commission, dismisses a proceeding in which Cities Service Gas Producing asked for a rehearing of the rejection of the rate filings. The company originally filed the rate schedules September 13, were rejected October 13. The company then asked for a rehearing, which was granted on December 14. The hearing was held February 10 and 11.

Atlantic Seaboard to Build Short Line

The Commission has authorized Atlantic Seaboard Corp., to construct approximately 84 miles of pipeline and 2,000 additional compressor horsepower on its system in West Virginia, Virginia and Maryland.

The 26" line will parallel sections of Seaboard's existing line to Baltimore at various points. The additional horsepower will be installed at an existing compressor station in West Virginia. Total estimated cost of the project is $9,281,500.

The proposed new facilities are designed to enable the company to meet estimated requirements of its customers next winter. Seaboard had stated that its existing system is approximately 70,500 Mcf per day deficient in capacity to meet estimated peak-day requirements during the 1955-56 winter.

Experimental Compressor Station By Gulf Interstate

An experimental unattended compressor station will be built near Stanton, Ky., by Gulf Interstate Gas Co. under a recently-issued certificate.

The station will be controlled by personnel at a station 80 miles away, at Clementsville, Ky. The company plans to operate the experimental station on a standby basis for a 15-month test period to determine the economics and feasibility of the nonattended operation.

The unit, to be installed on Gulf Interstate's 30" line, will be a 3,500-hp, 4-cycle, turbocharged, vertical gas engine, driving a centrifugal compressor through a speed increaser. Gulf Interstate said no other units of this type are being operated by any gas transmission company.

If Gulf Interstate decides to use the equipment on a permanent basis, it will request further certificate authorization, prior to termination of the test period.

El Paso Natural Rate Increase Effective Subject to Refund

An order has been issued making effective as of April 15, subject to refund, a suspended wholesale natural gas rate increase by El Paso Natural Gas Co., and at the same time granted permission to file changes in the suspended tariff sheets to reduce the amount of the increase by $118,900, to $17,781,000 per year. In addition, the company has increased its rates for the sale for resale of gas for power plant use by about $213,000 per year.

The proposed increased rates, other than those for power plant use, were suspended by an order issued November 15, with the suspension period extending to April 15.

The changes which El Paso was permitted to file in the suspended tariff sheets include rate schedules for the sale of gas for resale for irrigation pumping use. El Paso previously has included this type of sale under its non residential service schedules. The proposed irrigation pumping rate is lower than the nonresidential rate, accounting for the $118,900 reduction.

The increase affects 28 wholesale customers in California, Arizona, New Mexico, and Texas.

Decision on 4 Producers' Rates; 15 Others Filed

Recent actions suspended 4 rate increases proposed by independent natural gas producers, and accepted 15 for filing.

The 4 suspended increases total $70,149 on an annual basis. The 15 which were accepted without suspension total $2,691 yearly, and include 7 tax increases amounting to $1,393 annually.

Producers' Petitions Denied; Phillips Increase Effective

The Commission has denied petitions filed by 12 independent natural gas producers seeking reconsideration and vacation of rate suspension orders.

Two producers asked FPC to reconsider its actions of March 2 suspending proposed increases to Trunkline Gas Co.

The other 10 producers were seeking reconsideration of FPC orders issued March 22 suspending proposed increases to Cities Service Gas Co.

Commissioner Digby dissented on both actions.

In another action, FPC issued an order making effective, subject to refund, a $223,926 annual rate increase by Phillips Petroleum Co., for sale to Northern Natural Gas Co. The increase was suspended December 31.

Petition for Rehearing on Producer's Rates Denied

The Commission refused to reverse its denial of the joint petition by Public Service Commissions of Virginia, Maryland, West Virginia, and District of Columbia that the rate increases of certain independent natural gas producers be suspended.

The Commission said 125 rate filings with proposed increased rates to Tennessee Gas Transmission Co. were filed last October by independent producers. These filings were not suspended by the Commission within the 30-day period allowed in the Natural Gas Act and they went into effect. Tennessee Gas then proposed to increase its rates in order to pay the increased rates of the producers. The Commission suspended Tennessee's increase, later permitted to go into effect subject to refund, on December 15.

Again pointing out that the suspension of rate increase is a matter of discretion the Commission says that the petitioners have not shown that there was any abuse of discretion in this instance or that there is merit in the legal arguments of the petitioners.

Transcontinental's Proposed Refund Method Approved

The Commission issued an order approving the method proposed by Transcontinental Gas Pipe Line Corp to making refunds of more than $1,822,000, excess charges collected during more than 2 years when certain disputed financing items were reflected in the company's rates.

FPC affirmed on March 15 an earlier order directing Transcontinental to exclude, from its gas plant accounts, $5,215,368 of disputed financing costs totaling $5,372,025. The question of whether the company should be permitted to include the disputed items in its rate base arose in a proceeding which was settled, except for this issue, on December 30, 1953. The action in excluding these items resulted in Transcontinental's being required to make refunds on its rates collected since March 18, 1953, when the $9,819,000 increase first became effective, subject to refund.

In compliance with the Commission's March 15 order, Transcontinental filed revised tariff sheets, reflecting exclusion of the disallowed financing costs, and also submitted its proposed method of making refunds.

Rehearing Denied on Certificates to 4 Producers

The Commission denied petitions by State of Wisconsin and Tennessee Public Service Commission requesting rehearing of the FPC order issued May 9 granting certificates to 4 independent producers authorizing them to sell natural gas to American Louisiana Pipe Line Co. for transportation through its proposed Louisiana-to-Michigan pipeline system.

Gas Industry news

Wimberly New President — Smith Chairman of Houston Natural

New assignments for its 2 principal executives were announced last month by Houston Natural Gas Corp.

J. H. Wimberly

F. C. Smith

John H. Wimberly, formerly executive vice president, became Houston Natural's president, climaxing the quarter-century of continuous employment with the company covering his entire business career.

Frank C. Smith, president for 22 years, was elevated to chairman of the board, succeeding the late L. S. Zimmerman.

Cecil E. Burney, Corpus Christi attorney, was elected a director, filling the vacancy created by Zimmerman's death.

A native-born Houstonian, Wimberly attended Houston public schools, Rice Institute, and received his B.B.A. degree from the University of Texas in 1927. He joined Houston Natural Gas Corp. in 1926.

His progress from a beginning job as chief clerk in the accounting department to the presidency included the offices of treasurer, vice president and treasurer, and executive vice president. He has been a member of the board of directors since 1940.

Wimberly is prominently identified with business, civic and church affairs. He has served as president of Houston Junior Chamber of Commerce, Better Business Bureau of Houston, Episcopal Churchman's Association, and Houston Chapter of Ex-Student's Association of University of Texas. He is a director of Houston YMCA, and a trustee of St. Luke's Hospital.

In 1952 Wimberly was elected president of Southern Gas Association.

Smith, now board chairman, left the banking business in 1933 to become president and general manager of Houston Natural. He will continue to devote his full time to the company.

During his 2 decades as president, the company's growth has climbed from fewer than 30,000 customers in 50 communities to more than 210,000 customers in 91 communities along the Texas Gulf Coast; investment in plant and property has increased from $5,800,000 to $35,000,000.

Smith achieved wide recognition for his gas industry service through his presidencies of American Gas Association and Southern Gas Association.

Canadian Gas Association convention details are discussed by P. W. Geldard, left, incoming CGA president, and engineer of distribution, Consumers' Gas Company, Toronto, with S. B. Severson, Dominion Natural Gas Co. Ltd., Buffalo, immediate past president.

Seattle Gas - Washington A&E Ready to Merge

Directors of Seattle Gas Co. and Washington Gas & Electric Co. have unanimously signed an agreement to merge the 2 companies.

The separate actions of the boards were announced by Walter S. Byrne, president, Seattle Gas, and Allen Peyser, president, Washington Gas & Electric.

The merger proposal, which requires approval of shareholders of the companies and the Washington Public Service Commission has been given a detailed and impartial study by Stone & Webster Service Corp.

"The merger will not only benefit shareholders of the companies but will provide benefits to customers of the two gas distributing companies and to the entire region we serve," Bryne and Peyser said.

"The advent of natural gas will provide new opportunities for industrial and commercial expansion in western Washington. To take advantage of those opportunities, and to better serve the people of the region, the stronger company will be able to secure financing at more advantageous terms. Through elimination of duplicate operations substantial economies that will benefit both domestic and commercial customers will be effected," they said.

New York Security Analysts Hold Weekly Utility Forums

New York Society of Security Analysts has designated Wednesday as the day for its utility luncheon forums. At each meeting which includes a talk, usually by a utility company president, followed by a discussion or question period, the analyst is able to get a better understanding of a utility company and the policy of its management than can be obtained from published sources. At the same time, the forum affords utility management an opportunity to become better acquainted with the thinking and needs of analysts and representatives of the New York financial institutions. Printed copies of talks are often sent to the 2,100 members of the NYSSA and frequently to the 4,600 members of The National Federation of Financial Analysts Societies.

The utility program committee invites speakers from a representative group of large and small companies in the various branches of the utility industry. During the 1954-1955 season, 38 forums were held.

Members of the utility program committee for 1955-1956 are: C. E. Trefthen, chairman, Goldman, Sachs & Co.; David Cowan, Shearson, Hammill & Co.; Marjorie H. Cruthers, Irving Trust Co.; Maurice E. Dixon, Merrill Lynch, Pierce, Fenner & Beane; Frank P. Glass, Chemical Corn Exchange Bank; David W. C. Rothrock, Lionel D. Edie & Co., Inc.; and Alvord D. F. Stearns, The Hanover Bank.

Rockwell Tests New Lubricant in Special Sub-Zero Chamber

A special sub-zero chamber to duplicate field conditions was used at Rockwell Manufacturing Company's meter and valve testing station to test a newly developed valve lubricant for hydrocarbon gas lines operating at temperatures ranging from — 50 F to 120 F.

Tests were performed in a walk-in deep freeze icebox composed of a test room and an antechamber. Before entering the test room, engineers became acclimated to low temperatures in the refrigerated ante-chamber to prevent possible harm from sudden change. The entire system is cooled by a 3-stage compressor and exhaust system which takes about 5 hours to reduce the temperature from 70 F to — 50 F.

The experimental lubricant formula was tested in a 24" Rockwell-Nordstrom valve. A standard-type valve stem packing was used and the compound gear was greased with a special low temperature gear grease. The valve was mounted in the deep freeze chamber on a fabricated steel framework for stability. Nitrogen was used as the line fluid and was hooked up so gas could enter valve from either flanged end. A regulator was provided to permit close pressure control.

Results of the test program indicated the new lubricant gave a leak-tight seal at the temperatures range and at 50 psi and 800 psi pressure, both balanced and unbalanced on either flange.

While the test was underway, the valve was readily relubricated at —50F by a Rockwell hand gun.

Jury Favors Gas Co. in Suit Following Manhole Explosion

Believed to be Landmark Case

Consolidated Edison Company of New York won a notable victory in a New York Supreme Court recently, when a jury returned a verdict in its favor at the trial of a $75,000 action instituted by 2 telephone company employees to recover damages for injuries allegedly sustained as a result of an explosion in a telephone manhole in White Plains, December 3, 1951.

At the time of the accident, the plaintiffs were making electrical tests in the manhole to locate telephone cables under a road in connection with efforts of Con Edison employees to locate a gas leak in the vicinity.

There was sharp conflict in the testimony at the trial as to whether the telephone men had notice of the presence of gas in the manhole, prior to the explosion. The telephone men maintained that a Con Edison employee had tested the air in the manhole and informed them there was no gas present and that it would be safe to work in the hole.

In direct contradiction, 2 Con Edison employees, including the foreman on the job, testified that there was a definite and strong concentration of gas in the manhole and that one telephone man was given special warning of this before entering the hole. The plaintiff's contention was weakened by evidence that a few hours prior to the accident a supervisory employee of the telephone company had refused to enter the manhole because of noticeable gas odor.

The jury's finding that the plaintiffs were guilty of contributory negligence apparently was based upon the failure of the injured men to follow telephone company safety regulations, prescribing precautions to be observed before entering a manhole when the presence of gas is suspected, despite their admissions that they were aware of the regulations and had copies of them.

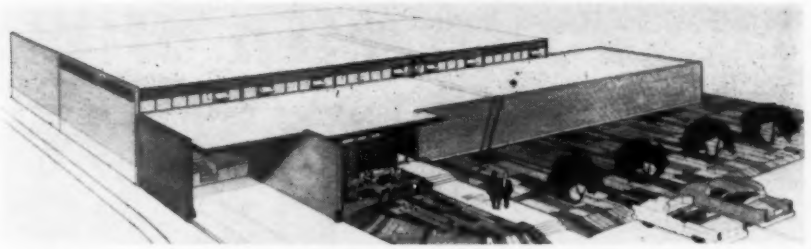
Oates Cites 10 Years Progress in 1954 Par Annual Report

During 1954 the PAR plan of the gas industry completed its first 10 years of existence, James F. Oates, Jr., chairman, PAR committee, stated in the 1954 annual report. Mr. Oates, who also served as PAR chairman in 1953, is chairman of The Peoples Gas Light and Coke Co., Chicago.

Financial support from utility and pipeline companies has increased from an annual average of $1,552,000 for the first 3 years of the program, 1945-1947, to $2,222,000 in 1954. A substantial part of the increase has been required to meet higher costs of research and advertising and has not been available to provide for a much needed expansion of the program.

Mr. Oates pointed out that the greater financial support achieved in recent years was provided by fewer companies representing a smaller proportion of total industry meters.

A new PAR subscription pattern, designed to obtain greater support was prepared by the 1954 committee and adopted by the AGA board of directors. Early responses received in 1955 indicate success in achieving an increase in support in terms of funds provided and the number of company subscribers.



Universal Control Corporation's planned new plant near Dallas.

May Construction 13% Over 1954

The May dollar volume of contract awards for future construction in the 37 states east of the Rockies was 13% above the contract total for May 1954 and was the third highest of any monthly total recorded in the history of F. W. Dodge Corp. The total was $2,185,065,000.

The 5-month total of $9,727,562,000 set a new high and was 29% above the corresponding figure for last year, the previous high.

For the second month, Dodge's residential classification topped $1-billion, $1,011,310,000 in residential building contracts were 23% above May 1954.

Nonresidential building totaled $725,755,000 in May, and was 8% over May 1954. Public works and utilities totaled $448,000,000, 5% over 1954's figure.

Rockwell Manager Honored for Service to Southwestern Measurement Course

William R. McLaughlin, Southwestern regional sales manager, meter and valve division, Rockwell Manufacturing Co., received a scroll from the executive committee, Southwestern Gas Measurement Short Course, at University of Oklahoma, honoring 32 years of service to the course.

W. R. McLaughlin

The scroll was presented at a dinner for past chairmen of the Course, marking the opening of the 30th session.

McLaughlin is the only past chairman who participated in every course since the first one in 1924, including committee meetings in 1933 and 1934, when no sessions were held.

He served on the general committee, 1929-through-1945, has held the chairmanships of every subcommittee and conducted classes on practically all phases of gas measurement and regulation.

Universal Controls Buys Six Acres in Texas for New Modern Plant

Universal Controls Corp. has purchased 6 acres in Carrollton, Tex., for construction of a new plant, that will accommodate an expansion in the company's business, it was reported.

The plant, which will be used for building gas distribution products, will have masonry construction, will be insulated throughout and will be air conditioned in both the office and manufacturing area. Gas engines burning natural gas supplied by Lone Star Gas Co., will be used for driving the air-conditioning equipment.

In addition, a gas engine driven air compressor is planned, for supplying air needed for testing the company's regulators and other manufacturing operations. Universal expects to occupy the building in September.

New Out-of-State Gas Supply for California in 3-Company Deal

Substantial new supplies of out-of-state natural gas to meet growing demands in California have been arranged for by 3 major gas utility companies: Pacific Gas and Electric Co., Southern Counties Gas Co., and Southern California Gas Co. The three companies have reached agreements with El Paso Natural Gas Co. for purchase of an additional 450 MMcf daily. The new agreements add 250 MMcf to contracts for 200MMcf signed last summer.

The gas will come from the San Juan Basin in New Mexico and neighboring states. Deliveries of the new supply will begin late next year.

The additional imports will bring to 1.85-billion cf daily the gas being brought into California. The present and proposed imports are apportioned equally among the companies.

The arrangements are subject to approval of Federal Power Commission and California Public Utilities Commission.

In order to bring the new gas to California, El Paso Natural proposes to parallel its present transmission line from San Juan Basin, and the California companies will build additional transmission facilities to their distribution centers.

The proposal reportedly hinges upon the completion of the pipeline from the San Juan Basin in Colorado and New Mexico to the Pacific Northwest, which was authorized by the FPC last year.

Men at Work

Tom G. Cross, Lone Star Gas, Honored For 25-Year Service

Tom G. Gross of Dallas completed 25 years as an employee of Lone Star Gas Company July 15. This service record makes him a member of the company's Ruby Club eligible to wear a ruby-studded lapel button recognizing his quarter-of-a-century of employment.

Cross began his career with Lone Star on July 15, 1930, as a stenographer in the tax department. After serving as chief clerk of the department for several years, he began meeting with tax boards of equalization in 1938 and several years later was appointed assistant tax agent. He was named tax agent in 1951 and on January 1, 1954, was appointed to his present position of manager of Lone Star's *ad valorem* tax department.

Cross was a student at Sul Ross State College in Alpine for three years. He attended Southern Methodist University Law School at night, receiving the Bachelor of Law degree in 1949. He is a member of the Board of Stewards of the Oak Cliff Methodist Church where he is active in Boy Scout and other youth work.

H. CARL WOLF, GAS UTILITY EXECUTIVE, DIES

H. Carl Wolf, for many years a prominent executive in the utility industry, died June 26 in White Plains, New York. Wolf entered the utility field after being graduated from the University of Illinois with BS, MS and EE degrees. He joined the Illinois Commerce Commission and later became manager of the Edwardsville, Illinois, Water Company.

He served as chief engineer of the Public Service Commission of Maryland, later joined Central Public Service Corporation in Indiana. He became vice-president of Consolidated Electric and Gas Company, and then was elected president of Central Indiana Gas Company, Muncie, Ind., and all of its associated companies. In 1938, Wolf became president of the Atlanta Gas Light Company, Georgia, and its affiliated companies.

After serving as a director and as chairman of its National Advertising Committee, Wolf was elected managing director of the American Gas Association, the national trade association of the gas industry, in October, 1945. There he played a prominent part in the expanded program of promotion, advertising and research, which the gas utility and pipeline companies have carried on for the past ten years.

Ill health forced him to take leave of absence from his duties as managing director about a year ago. He resigned from this office earlier this year, but was retained as a consultant to the Association. Last spring the board of directors of AGA tendered him a testimonial dinner as a tribute to his long and important contributions to the gas industry, at which time he was presented with an engraved testimonial of appreciation. Marion F. Banks said at this dinner, "Because he gave so much of himself, the whole industry, as well as the American Gas Association, made tremendous advance during the nine years of Mr. Wolf's leadership."

P. S. Dickey H. H. Gorrie

BAILEY METER CO. MAKES TOP EXECUTIVE CHANGES

Paul S. Dickey, formerly vice president and a director of Bailey Meter Co., has been elected president, succeeding Robert S. Coffin, who was elected chairman of the executive committee and named management consultant.

Coffin has been with the company since its establishment in 1916 and was president since 1944.

Harvard H. Gorrie, chief engineer, has been elected vice president in charge of all engineering activities.

Dickey, associated with the company since his graduation from Purdue University in 1925, started as a cadet engineer. In 1928 he was assigned to the engineering and research department. He served as chief research engineer, marine control consultant, and was appointed chief engineer in 1944, and vice president in 1947.

The holder of numerous patents, Dickey is recognized as an authority on power plant and process control. In 1953 he received the honorary degree of Doctor of Engineering from Purdue University.

Gorrie was graduated from Rensselaer Polytechnic Institute in 1927 and then joined the company. In 1944 he became head of the design department, was appointed assistant chief engineer the following year, and chief engineer in 1953.

Elliot Named Crane Co. President

Frank F. Elliott was recently named president of Crane Co., replacing John L. Holloway.

Brinkman Joins Stacey Mfg. as VP

Herbert C. Brinkman recently joined The Stacey Manufacturing Co., as vice president-chief engineer. He has been with Stacey Brothers Gas Construction Div., Dresser Industries, Inc., for 30 years.

Tippy Is Commonwealth President

William B. Tippy has been elected president, Commonwealth Services Inc., succeeding Granville H. Bourne, who was elected to the newly created office of chairman of the board.

Tippy was formerly executive vice president and a director. He became associated in 1945 with The Commonwealth & Southern Corp., predecessor of Commonwealth Services Inc.

ROCKWELL ELECTS KREUCH AND FOUBERT VICE PRESIDENTS

Paul C. Kreuch, assistant to vice president in charge of Rockwell Manufacturing Company's meter and valve division, has been named a vice president in that division, and Eugene F. Foubert, manager of industrial relations for the company is vice president, industrial relations.

Kreuch joined Rockwell in 1930 as sales engineer. He had spent 7 years in the gas industry, including 3 years as chief engineer of Missouri Public Service Co.

Foubert joined Rockwell in 1941 as personnel manager of the Oakland, Calif., plant. In 1945, he was named manager of industrial relations for that plant and was transferred to Pittsburgh in 1947.

Worthington Ups Walter-Sherwood

Hellmuth Walter has been named director of research at Worthington Corp., and Robert S. Sherwood has been appointed assistant director.

Walter became a consulting engineer at the company's Wellsville works in 1950, and in 1951 was transferred to company headquarters at Harrison, N. J.

Sherwood joined Worthington in 1951 as a consulting engineer. In addition to his new duties, he will continue to handle administrative patent responsibility.

LP-GAS STORAGE

Continued from page 17

including bottle gas operations. A fractionator is employed to remove heavy ends which may have come in from the pipeline. The overhead product (propane) is then died in an activated alumina dehydrator before going to surface storage from which it is loaded into tank cars or tank trucks. Fractionator boilers are fueled by vapors withdrawn from the top, or vapor phase, of the cavern. The cavern is equipped with a float gauge read at ground level and cavern temperatures are determined by thermocouples.

Costs of mined caverns can also vary widely due to the nature of the formations encountered. Cost may be as low as $4 per bbl for large caverns in shale and as high as $8 per bbl in more diffiuclt formations.

COSTS OF LP-GAS STORAGE

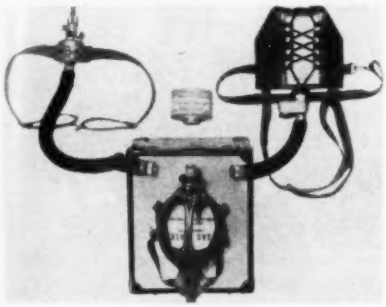
Design WP	Type storage	Cost per bbl, $
Aboveground Storage		
250 psig	30,000-gal horiz.	24.0 - 31.0
125 psig	30,000-gal horiz.	20.3 - 27.5
125 psig	81,000-gal horiz.	15.3 - 21.0
125 psig	4,000-6,000 bbl. spheres	18.9 - 26.0
75 psig	45,000-gal horiz.	19.0 - 24.9
75 psig	63,000-gal horiz.	14.7 - 19.5
75 psig	6,000-spheres	13.8 - 19.9
Aboveground Storage Refrigerated		
75 psi	15,000-gal sphere	12.2 - ?
25 psi	5,000-7,500-gal spheroids	12.1 - 25.8
25 psi	45,000 gal horiz.	20.5 - 30.5
Underground Storage		
Cavities dissolved in salt		0.5 - 4.0
Mined		4.0 - 8.0

new Gas Industry equipment

Gas Mask Kit—Acme Protection

A gas mask kit designed to meet plant hazards for maintenance men has been announced.

This maintenance mask provides a full-vision face piece for dust and smoke protection; a canister mask to protect against all gas hazards and visible smokes from



fires; and an air-supplied mask, plant compressed air, for use in any harmful or objectionable atmosphere.

According to the company, the maintenance man is prepared to meet any hazardous atmospheric condition in the plant with this multi-purpose mask equipment.

Acme Maintenance Mask. Acme Protection Equipment Co., 1201 Kalamazoo St., South Haven, Mich.

Spin Torque Chuck—Toledo

A new spin torque chuck with special rocking-wedge jaws which tighten as torque is applied, a spin of the hand wheel closes the jaws quicskly and smoothly on this unit. No hammering is necessary because the jaws pull up tight under normal hand pressure. Diagonal serrations on the jaws eliminate end thrust slippage and permit either clockwise or counterclockwise rotation.

The spin torque chuck clamps rod or bolt from ¼" up and pipe or conduit ⅛" to 2". Jaws are set flush with the face of the chuck to prevent injury to fingers and to allow pipe fitters to thread pipe right up to the face of the chuck, itself.

Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo 4, O.

Coatings—Corrosion Control

A new line of chemical resistant coatings and linings for plant maintenance, this series features two neoprene based agents which are said to offer effective protection against a great many corrosive reagents and over a wide temperature range. The first is a room temperature spray or brush coating applicable to any type of surface and resistant to chemical spills, fumes and drips with a temperature range of —20° F to —275° F. Brushed on coatings give a dry film thickness of 4-5 mils per coat which are unaffected by sunlight and weathering. It is resistant to all salts and alkalies and offers excellent resistance to acids.

The second in the series is a chemical resistant lining designed for emersion service. It has an effective temperature range from —65° F to 300° F. Spray or brush applications have been made to give a film thickness of 20-30 mils per coat.

Neocor C-10 and Neocor HD. Corrosion Control Co., Inc., 516 Fifth Ave., New York, 36.

Pipe-Bolt Threader—Beaver

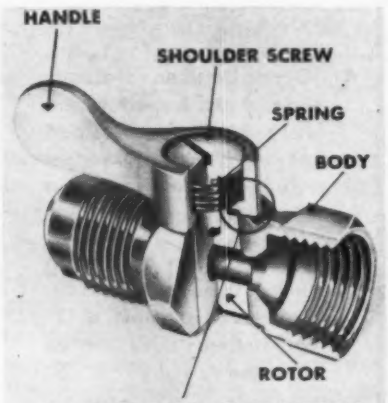
An improved model pipe and bolt threading machine, this unit is said by the company to be the fatest portable pipe machine available today. This high speed machine threads 2" pipe in in 10 seconds; ½" pipe in 3 seconds. It is equipped with a power grip wrenchless chuck which reduces the time required for chucking, compared to former wrench type chucks, and it is claimed that use of the power grip chuck increases the safety of machine operation.

Pipe and Bolt Threading Machine. Beaver Pipe Tools, Inc., Warren, O.

Fixed Adjustment Valve — Deutsch

An AGA-listed gas valve which is said to combine safety features of fixed-adjustment lock nut types with spring-loaded plug types, has been introduced.

This valve is basically fixed-adjustment with spring takeup to provide leak-proof

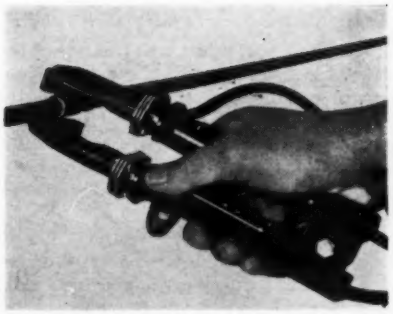


CONTACT AT THESE POINTS PREVENTS DISPLACEMENT OF PLUG BY FORCE.

service regardless of usage and wear. Danger of the valve becoming unseated by axial load against spring bearing end of the plug, is said to be eliminated. Spring is contained within head of plug, making it impossible for plug to become unseated. Sealing surfaces remain in contact at all times.

This line of valves is available for connection with iron pipe, hose and flared tubing.

Gas Valve Div., The Deutsch Co., 7000 Avalon Blvd., Los Angeles, Calif.



Portable Soldering Set—Wassco

A tool for soldering copper tubing, this portable soldering set consists of an all-electric pliers soldering device and a 1000 w portable power unit. It features safety and ease of use as there is no open flame, burn or fire hazard.

The unit is used primarily for soldering copper tubing sweat fittings up to 1¼" size, but works also with efficiency on heavy electrical wire and cable and on many other heavy soldering jobs. Its many advantages include portability, including a pocket for pliers and leads, push-button heat control in the pliers handle, and 10' leads. It will solder ½" tubing fittings reliably liquid tight in only 20 seconds.

Wassco Electric Products Corp., Joliet, Ill.

Burner Safety Control—Electron Corp.

This control system is designed for safe lightup and operation of multiple burner boilers. It consists of a prewired and tested control cabinet assembly, all necessary controls, timers, valves and accessories for a complete installation.

The system provides starting and operating flame failure protection for 1-to-4 burners: gas, oil or gas-oil fired; manually or semi-automatically ignited. Flame failure protection is provided for each burner by 2 scanners; one monitors the pilot and the other the main flame. The main fuel valve is not allowed to open until the pilot is established. It develops a purge time sufficient to produce 4 air changes in boiler; a green light shows operator he may continue lightoff procedure.

A timer limits trial-for-ignition for each burner to 10-sec., after which fuel valve closes if main flame is not ignited. When flame failure occurs at any burner during lightoff or operation, an alarm sounds and red light for burner comes on.

Fireye Integrated Control System. Combustion Control div., Electronics Corporation of America, 718 Beacon St., Boston 15.

ACF Lube Manual

This bulletin offers information covering the lubricants for the company's plug valves. It is amply illustrated and offers cross sectional views of the valves and pertinent data about their construction. Sections of the bulletin are devoted to: forms of lubricants; descriptions of lubricants; service recommendations; features of the valves; lubrication of the valves; and lubricating equipment.

Bulletin No. 3. Pp. 16. ACF Industries, Inc., Valve Div., 1501 E. Ferry Ave., Detroit 11, Mich.

Resin Coating — Pennsylvania Salt

Availability of a low cost trial kit of this new resin coating product for humid and corrosive atmospheres was announced by the company. Designed for testing purposes, the kit contains two quarts of the coating, one quart of lock prime, a quart of thinner, complete specifications and directions for use.

The coating system is described as providing a durable protective coating for new or corroded metal, concrete and wood surfaces exposed to fumes, corrosive atmospheres and spillage of destructive chemicals.

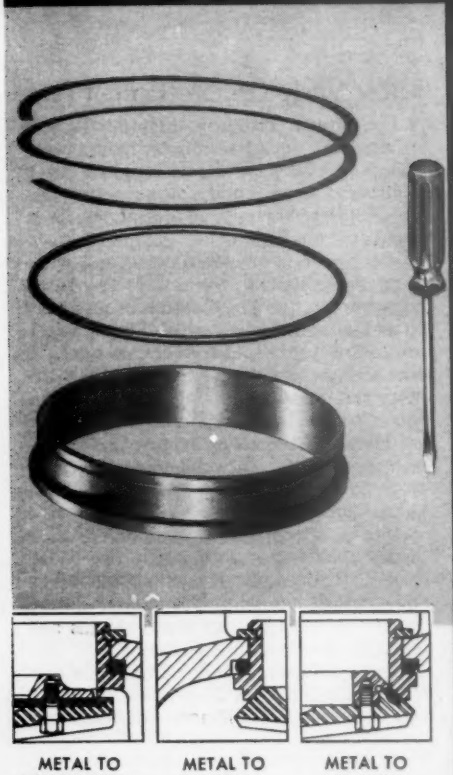
It has excellent flow qualities and is applied like regular maintenance paint by brush, roller or spray as it comes from the can. In a three-coat system—one primer and two top coats—it will build up to a minimum of 6 mils dry film thickness. Containing over 60% solids by weight, it assures protection on edges, prominences and crevices, as well as on plane surfaces. Regularly offered in white, green, slate gray, silver gray, and black, it may be obtained in other colors on special order.

Thick-Coat. Corrosion Engineering Dept., Pennsylvania Salt Manufacturing Co., 1000 Widener Bldg., Philadelphia 7, Pa.

...announcing

REYNOLDS' REMOVABLE ORIFICES

in single district station and high pressure line regulators which has been in use 3 years



1. To remove orifice, a screw driver is the only tool needed.
2. Orifice may be had in any metal, normally stainless steel.
3. Types—Seats for orifices:
   Flat Disc—Composition or Leather
   Metal to Metal
   Metal to Metal with "O" ring
4. "O" ring between valve body and seat assures perfect parallel seating as well as perfect height seating. Does not require close valve height adjustment.
5. Valve seats may be sized as much as three regulator sizes smaller. For example, a 12" regulator may have inserted valves the size of 10", 8", 6" regulators.

METAL TO COMPOSITION VALVE SEAT | METAL TO METAL VALVE SEAT | METAL TO RUBBER VALVE SEAT

GAS CONTROL Since 1892

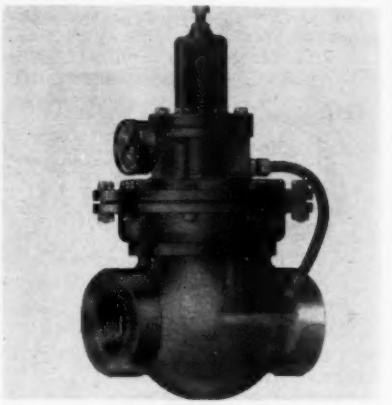
Reynolds Gas Regulator Co.

ANDERSON, INDIANA, U. S. A.

Back Pressure Regulator—BS&B

This new type back pressure regulator with integral controller for services where close regulation and complete closure are required in a single instrument, was designed for optimum control on low pressure gas gathering lines and other equipment requiring close pressure control as well as tight shutoff. The unit works equally well, within its pressure limitations, in all gas or air services that require back pressure regulation.

The integral controller, which provides closer sensivitity to pressure fluctuations



than can be obtained with a weight loaded regulator, also has a wider range of adjustment than a regulator depending on direct spring loading.

Construction features include a high tensile cast iron valve body, spring housing and diaphragm casings; pressure transmission tube; pilot operating mechanism machined from stainless steel and aluminum; valve diaphragm with no center punching; nylon reinforced soft seat insert; stainless steel valve stem and valve seat machined into valve body.

Available sizes: 2" screwed globe, 3" and 4" flanged globe. Control range: 5-125 lbs. Temperature range: up to 165 F.

Type 73-22 Back Pressure Regulator. Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 26, Mo.

Heavy-Duty Diesel Engines

This bulletin describes features of the company's heavy duty diesel engines, 375-to-1,000-hp. The bulletin provides complete information about the lubrication, cooling and fuel injection systems of the engines. It furnishes details about engine housing design, full floating aluminum bearings, large diameter crankshaft, gear driven auxiliaries and other features. Included also are specification and dimension sections and a number of illustrations of the engines.

Bulletin 10,040. Pp. 20. Ingersoll-Rand, 11 Broadway, New York 4.

Barton Model 211 Indicating Switch

The indicating switch described in this bulletin actuates an audible or visual alarm, and indicates flow, liquid level or pressure differentials. The bulletin presents specifications, operating characteristics and outline dimensions.

Bulletin 211-1. Barton Instrument Corp., 1429 So. Eastern Ave., Los Angeles 22, Cal.

Sales Conference

(Continued from Page 26)

Into this box, a system of convection heating is designed, so as to apply heat uniformly and efficiently to the product, in order to obtain the desired results within the limits of the individual job's physical requirements.

Considering the box oven with its load and the proper air application within the unit, depending upon availability and economics, a heating medium is applied. This may be direct or indirect oil heating, direct or indirect gas firing, steam heating or electric heating. They are all used in batch oven equipment, for some process in which their use is applicable. We must recognize the fact that while the majority of batch ovens or ovens of any description built today, are heated by gas, there are still many units built using competitive fuels where justified by economics. The market for electrically heated convection oven has been steadily increasing, until today it is a real factor in the oven industry.

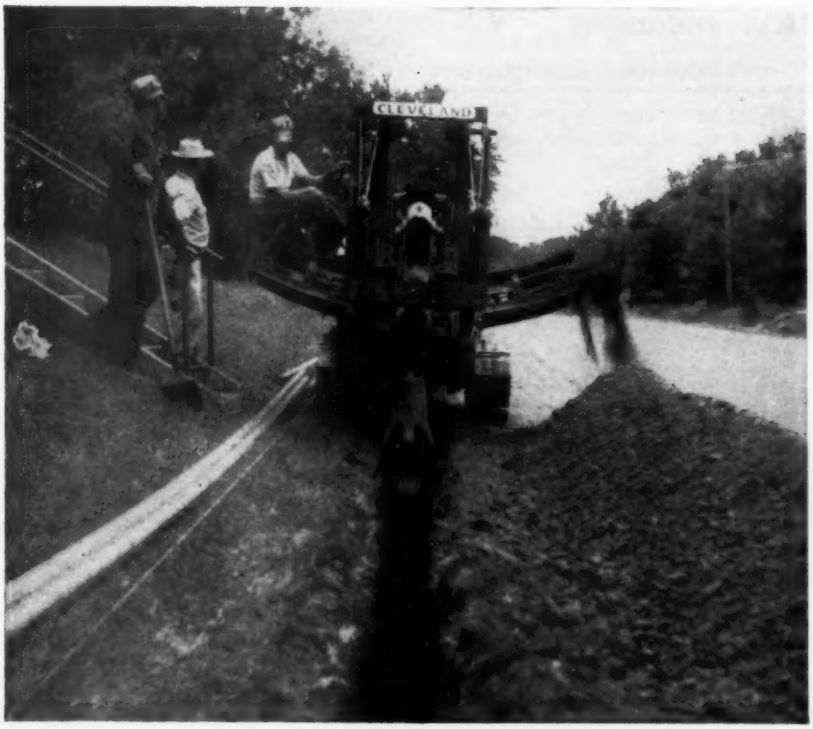
Finish baking
Core baking
Mold drying
Aluminum heat treating
Magnesium heat treat
Berylium copper heat treat
Steel tempering
Drying abrasive wheels
Armature and coil baking
Die preheating
Shell mold processing
Drying after plating
Dehydration of silica gel
Nylon setting
Rug drying
Processing meats
Testing instruments
Adhesive setting
Vacuum plating
Curing silicones
Curing brake linings
Preforming plastic
Shrinking metal-on-metal
Mold processing
Drying radiator cores

These applications are all meeting production requirements and do not include the so-called straight laboratory operation.

This wide diversity of application will show why the day of the so-called "standard oven" has passed. While we have standard types of units and standard basic designs, each unit must be set up in its finality from the standpoint of heat input, air movement, quantity and quality of air, refinement of temperature and safety control equipment, ventilation and lastly, physical limitation to meet the requirements of the job it is doing.

Most oven manufacturers will not quote blind on an oven requirement because we all realize that misapplication, as so often results from this practice, can hurt manufacturer, customer, utility and, in many cases, might even present a serious explosive hazard.

The wide scope of application of the batch oven points out the tremendous market for low temperature processing equipment that is in each and every territory. Ovens are excellent load builders.



Repair cost = $\frac{1}{50}$ ¢ per foot on 120,000 feet of extension work

CENTRAL ELECTRIC & GAS CO., Lincoln, Neb. with their Cleveland "Baby Digger" consistently dig an average of about 200 feet of trench per hour . . . a good production average on gas extension projects where numerous line obstacles are encountered both above and below ground.

Their Cleveland, shown above working easily along the edge of a lawn, recently completed more than 600 hours of trench digging—about a half year's work on use of this kind—with no need of repairs or parts replacement due to wear, or maintenance of any kind except normal lubrication and fueling. (One shaft was broken by improper sprocket installation during the regular operator's vacation, at a cost of $28.)

Performance like this—plus compactness and maneuverability, big capacity, and dependability in turning out high daily footage regardless of soil and weather conditions—goes a long way toward explaining why Cleveland "Baby Diggers" have been the gas industry's choice in trenchers for well over 30 years.

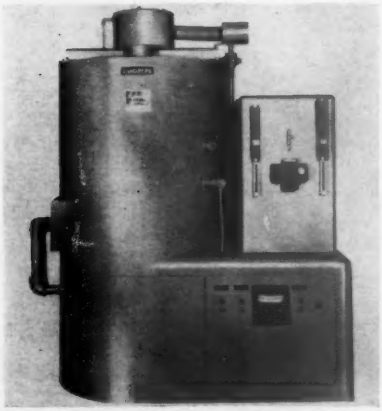
Fast moving, too! . . . Cleveland "Baby Diggers" hustle safely from job to job . . . at legal speed limits . . . because they are so easily portable on fast loading Cleveland trailers.

Write for Full Line CLEVELAND *Bulletin or see your Local Distributor*

THE CLEVELAND TRENCHER COMPANY • 20100 St. Clair Ave., Cleveland 17, Ohio

CLEVELAND

NEW Industrial Processing Equipment



Atmosphere Generator—Lindberg

An endothermic atmosphere generator, completely wired, piped, and assembled in a package unit is now offered. The generator is fully automatic for producing low cost protective atmosphere for bright hardening, bright annealing, or bright brazing of steel totally free from decarburization or carburization. Available in 500, 750 and 1500 cfh sizes, the unit is said to provide production economies and gives precise operation with ease of maintenance.

Design features include:

Instrument panel combined with generator, saving cost of separate panel plus installation.

Occupies less floor space.

Main components of mixing panel at waist level.

Carburetor can be cleaned without tools.

Larger catalyst bed.

Standard ceramic retort interchangeable with inconel retort for intermittent operation.

Safety equipment meets factory mutual specifications.

The generator produces protective atmosphere by cracking gas (natural, propane, butane, or manufactured) with air over a heated catalyst. The air and gas are accurately metered, automatically proportioned and mixed.

Completely reacted, dry, hot atmosphere can be piped to the heat treating furnace or can be cooled for metering and distribution to more than one furnace.

The generator is fully automatic. The operator lights pilot on gas burners, presses pushbuttons on control panel. When retort reaches temperature, mixing machine is started and atmosphere is available for use.

The automatic controls for temperature, mixing, pressure and flow make it possible to cut a furnace into or out of atmosphere line without returning to generator. The generator can be located remote from heat treating furnace.

Hyen Hydryzing Generator. Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12.

Control Initiating Instrument—G.E.

A new control initiating instrument, this unit is to be installed on switchboard or panel instruments, and is an automatic, all-electrical device for initiating action when a predetermined value is reached.

In operation, the system electrically picks up the signal from the instrument pointer which eliminates disadvantages of mechanical contacts. Because control of important variables is automatic, human errors and expenses are reduced.

Typical applications for the new instrument are: sound an alarm when the controlled temperature reaches a critical value, initiate control to contain cycles per second within specified range, shut down equipment at maximum vibration point, and shut down machinery drawing more than normal power.

The instrument is suitable for one-set point or two-set point initiation.

General Electric Co., instruments dept., Schenectady 5, N. Y.

Indicating Furnace Pressure Controller

This bulletin describes the manufacturer's indicating furnace pressure controller and its uses in measuring and controlling furnace operation. The unit's operating principle is presented, along with specifications on calibration, models available, scale, control action, control adjustments, standard accessories and position indicator.

Bulletin 7404. Pp. 4. Minneapolis-Honeywell Regulator Co., industrial div., Philadelphia 44.

Gas STANDBY

Packaged 12 mcfh plant designed and built by Draketown for...

★ Utility or Industrial standby
★ Peak shaving and augmentation
★ 100% Town or plant supply

A Packaged Draketown Propane Plant will help you reduce demand charges; provide a supply of gas during curtailment periods... at the turn of a valve... or supply that outlying section or plant 100% if desired.

DRAKETOWN PROPANE PLANTS
"Good Gas Insurance"

If you have a gas problem, we can help you. We operate from coast to coast and overseas.

Phone or write today—no obligation.

DRAKE & TOWNSEND INCORPORATED
Consulting • Design • Engineering • Construction
11 WEST 42ND STREET • NEW YORK 36, N. Y.

DRAGNET
leak detector

detects and locates leaks on any pressure piping system in a matter of minutes!

PATENTS PENDING

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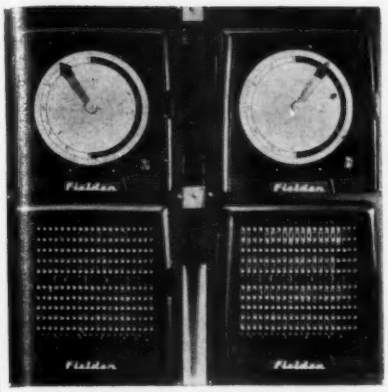


Process Scanner—Fielden Instrument

An electronic watchdog, which makes it possible to test and control continuously an unlimited number of industrial processes from a single vantage point, has been developed.

Called an indicating scanner, the instrument monitors process variables involving level, temperature, thickness, mechanical movement, tolerances, weight and pressure. It will keep a steady check on 6-to-48 and more steps in a process, the company said.

Speed of scanning depends largely upon number of points to be checked, with a maximum of one point per sec. Where a process strays beyond preset control zone, scanning stops and actuates an alarm. The indicator dial shows extent of deviation. Associated control systems may automatically correct condition.

By performing functions usually requiring many instruments, the scanner brings new economies to automatic production lines in chemical, petroleum and food processing; utilities; metal-working, paper; and other basic industries.

Indicating Scanner. Fielden Instrument Div., Robertshaw-Fulton Controls Co., 2920 N. Fourth St., Philadelphia 33.

Fireye Manual Reset Valves

Information about capacities, sizing, ordering, installation, wiring, and operation and maintenance of the company's manual reset valves, is presented in this new bulletin. The series of manual safety shut-off valves is used in connection with the company's flame failure safeguard control systems to automatically shut off the flow of fuel to an oil or gas burner in the event of flame failure. Specifications are given in the bulletin.

Bulletin CV-31. Pp. 4. Combustion Control Div., Electronics Corp. of America, 718 Beacon St., Boston 15, Mass.

Eclipse Walltite Injector Burners For High Pressure Gas

Specific burner dimensions and a listing of capacities are presented in this bulletin describing the manufacturer's injector burners for high pressure gas. According to the bulletin, the use of this combination mixer and burner provides a unit that is individual in control of air-gas mixture, gas input and has a high turn down range.

Bulletin H-63T. Eclipse Fuel Engineering Co., 1001 Buchanan St., Rockford, Ill.

A-P Solenoid Valves

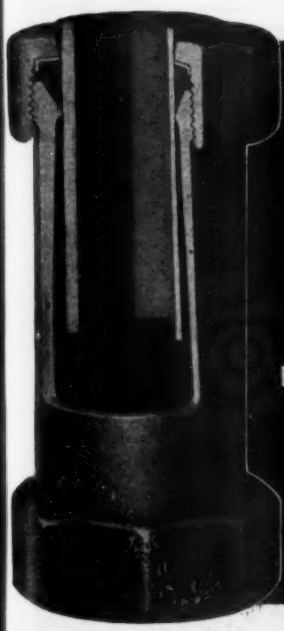
The manufacturer's entire range of solenoid valves, which are designed for use with liquids, gases or refrigerants and which can be used for stop-and-start operations—mixing and blending, metering or measuring, controlling pressure differential, controlling pressure, temperature and flow, are described in this bulletin. Information on proper selection, features, coil construction, lift ratings, coil frequencies and liquid capacity and typical applications are listed in the bulletin.

Bulletin RS141. Pp. 6. A-P Controls Corp., Advertising Dept., 2450 No. 32nd St., Milwaukee, Wis.

Wheelco Series 400 Capacitrols

New technical information about the application of automatic control equipment to the solution of industrial process control problems is presented in this bulletin. It discusses conventional millivoltmeter construction and its application to a control instrument. Also described is the function of an oscillator circuit in a pyrometer controller, along with various control forms which can be developed from this type circuit. Two pages are included which can be of help in determining the proper type control system to meet process requirements. Of particular interest to control engineers is the detailed description of saturable core reactor control for electric loads.

Educational Bulletin No. 9. Pp. 16. Wheelco Instrument Div., Barber-Colman Co., Rockford, Ill.



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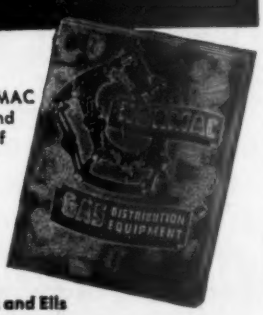

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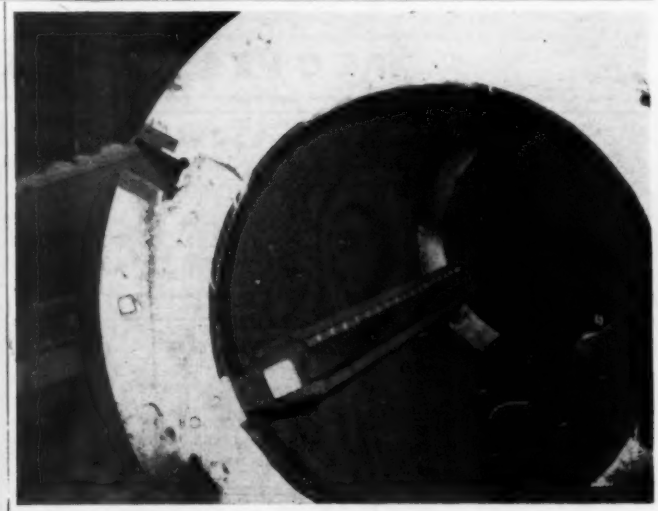

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Gas Industry CALENDAR

JULY

27-28 Michigan Gas Association, Mackinac Island, Mich.

28-July 1 American Home Economics Association, Minneapolis.

29 AGA board of directors, Denver.

AUGUST

4 AGA, jury of awards, home service achievement, Chicago.

15-Sept. 10 Southeastern Gas Association, short course in gas technology, Raleigh, N. C.

29-31 Appalachian gas measurement short course, West Virginia University, Morgantown.

SEPTEMBER

7-9 Mid-West Gas Association, school and conference, Iowa State College, Ames.

9 New Jersey Gas Association, Hotel Monmouth, Spring Lake.

11-13 INGAA, annual membership meeting, Jasper Park Lodge, Jasper National Park, Alberta.

14-15 AGA, accident prevention conference, Marion Hotel, Little Rock, Ark.

15-16 Action demonstration cities, representatives, Lincoln, Nebr.

16-17 Maryland Utilities Association, fall conference, Virginia Beach, Va.

25-30 International Gas Union, 6th conference, Hotel New Yorker, New York.

28 GAMA and AGA, gas industry development committee, New York.

OCTOBER

12-14 GAMA annual meeting, El Mirador, Palm Springs, Calif.

12-14 Wisconsin Utilities Association, electric and gas section, Schroeder Hotel, Milwaukee.

17 AGA board of directors, Los Angeles.

17-19 AGA-PCGA joint-convention, Los Angeles.

17-21 National metal show (AGA exhibit) Philadelphia.

18-21 American Dietetic Association, St. Louis (AGA exhibit).

18-22 National Safety Congress, exhibition, Chicago.

19 AGA, industrial gas breakfast, Penn Sherwood Hotel, Philadelphia.

21-Nov. 3 American School Food Service Association, Denver (AGA exhibit).

24-26 American Standards Association, Sheraton Park Hotel, Washington.

24-26 Pacific Coast restaurant convention, Biltmore Hotel, Los Angeles.

24-27 National Association of Railroad & Utilities Commissioners, Asheville, N. C.

NOVEMBER

7-11 National Hotel Exposition, Kingsbridge Armory, New York. (AGA exhibit.)

13-18 ASME, Congress and Hilton hotels, Chicago.

14-17 API, San Francisco.

16-18 Southeastern Gas Association, Roanoke Hotel, Roanoke, Va.

28-30 SGA advisory council and management conference, Point Clear, Ala.

JANUARY 1956

19 NEGA, operating division, Hotel Statler, Boston.

23-24 Industrial Heating Equipment Association, LaSalle Hotel, Chicago.

FEBRUARY 1956

6-10 Western Winter Radio-Television and Appliance Market, Western Merchandise Mart, San Francisco.

MARCH 1956

12-16 National Association of Corrosion Engineers, Hotel Statler, New York.

19-21 Mid-West Gas Association, Hotel Fontenelle, Omaha, Nebr.

22-23 NEGA, annual meeting, Hotel Statler, Boston.

APRIL 1956

4-6 AGA general management section, conference, Conrad Hilton Hotel, Chicago.

5 GAMA, automatic range conference, Hotel Pierre, New York.

16-19 AGA sales conference on industrial and commercial gas, Hotel Roanoke, Roanoke, Va.

19-21 GAMA annual meeting, The Greenbrier, White Sulphur Springs, W. Va.

23-25 SGA, 48th annual convention, Dallas.

MAY 1956

7-10 AGA, distribution, motor vehicles and corrosion conference, Congress Hotel, Chicago.

7-11 AGA commercial gas school, Edgewater Beach Hotel, Chicago.

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